THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LIX. No. 1518.] LONDON, JUNE 14, 1892. [44TH YEAR. PRICE 6d.

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1¼ to 12 IN. BORE.

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THE
GUIDE-FRAMING OF GASHOLDERS
AND OTHER PAPERS
CHIEFLY RELATING TO
STRAINS IN STRUCTURES CONNECTED WITH GAS-WORKS.
BY
F. SOUTHWELL CRIPPS, Assoc. M. Inst.C.E.

Reprinted from the JOURNAL OF GAS LIGHTING. *Fully Revised and Corrected by the Author, with many Additions.*

LONDON:
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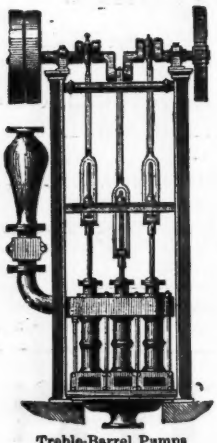
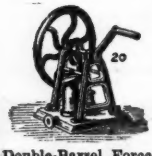
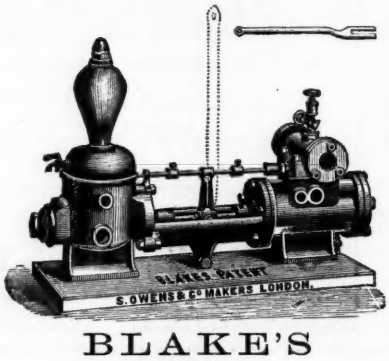


Treble-Barrel Pumps in Frame.

Syphon Pump



Double-Barrel Force-Pump in Frame.



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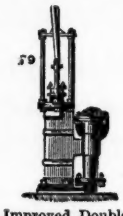

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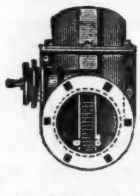

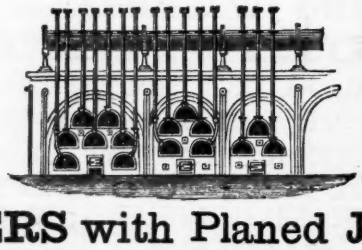

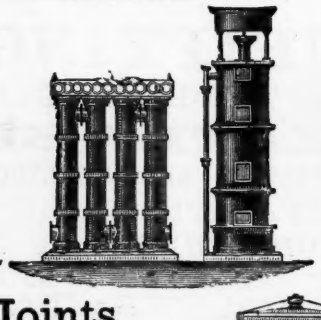

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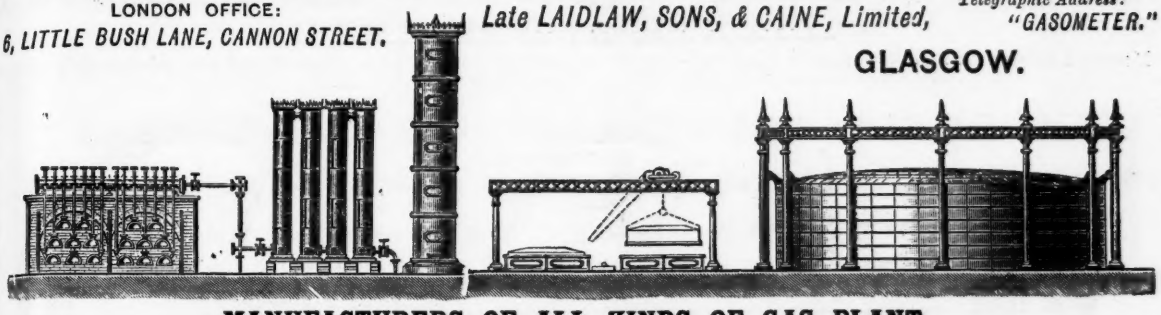

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RETORT-BENCH FITTINGS; SIEMENS'S REGENERATIVE AND ORDINARY FURNACES;
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GASHOLDERS, SINGLE-LIFT & TELESCOPE; CAST & WROUGHT IRON TANKS;
STATION METERS; GOVERNORS; SCREW AND RACK VALVES;
FOUR-WAY COCKS AND HYDRAULIC VALVES;
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GAS EXHAUSTING MACHINERY.

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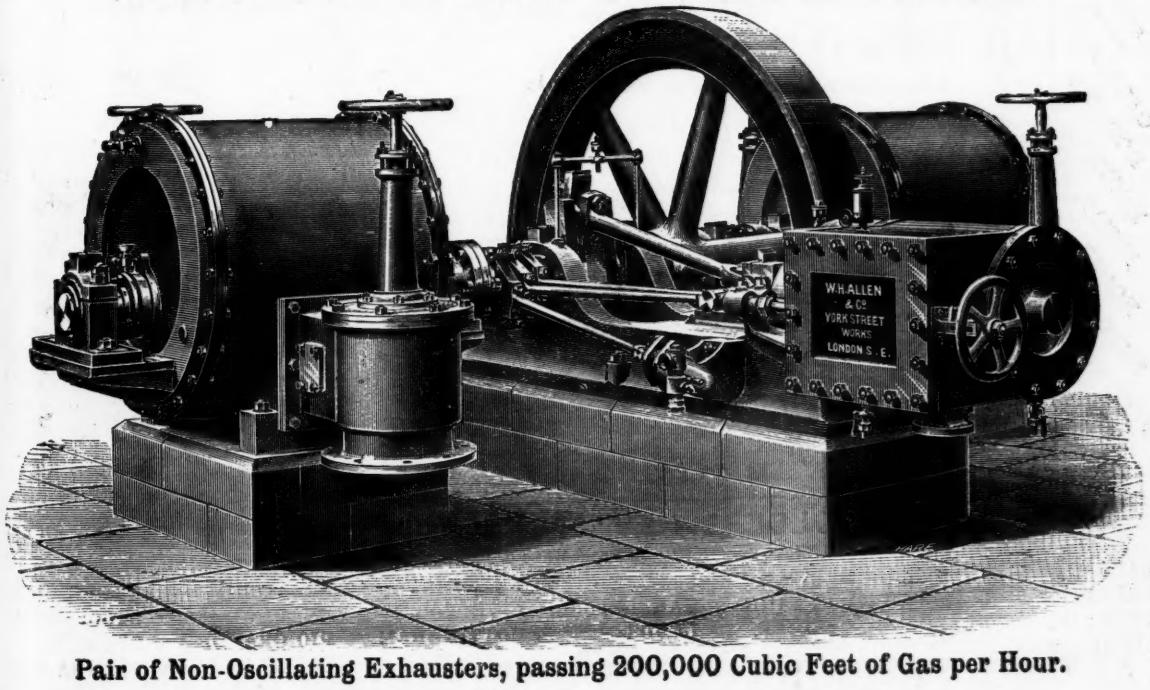
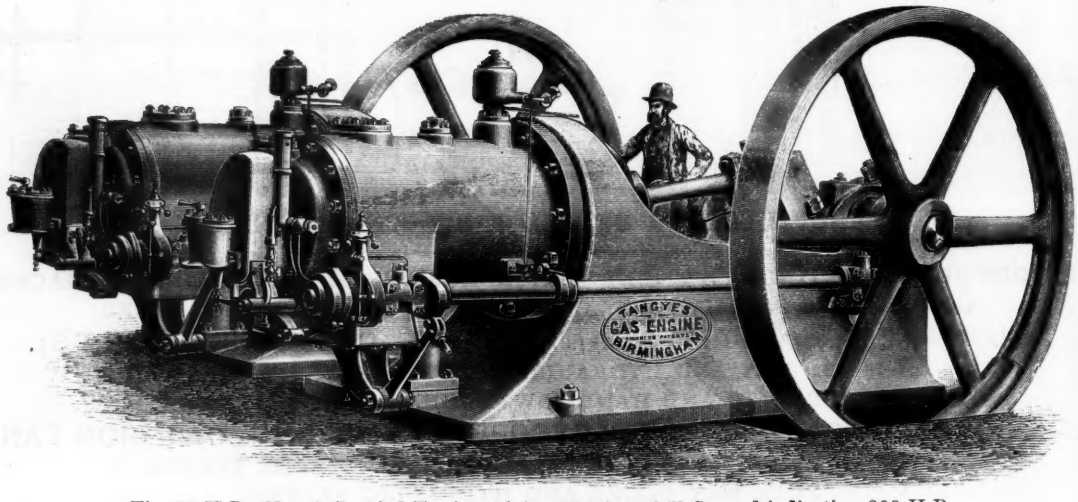


Pair of Non-Oscillating Exhausters, passing 200,000 Cubic Feet of Gas per Hour.

TANGYES' GAS-ENGINE

"OTTO" PRINCIPLE. PINKNEY'S PATENTS.

Messrs. Tangye have laid down special Plant and Tools for the manufacture of these Engines, and are able by their system of MULTIPLE MANUFACTURE and of WORKING TO GAUGE to turn them out in the best possible style.



The 70-H.P. (Nom.) Coupled Engine, giving 172 Actual H.P., and indicating 200 H.P.
Single Engines from ¼ to 146 Actual H.P. (=170 Ind. H.P.) and Coupled Engines from 86 to 292 Actual H.P. (=340 Ind. H.P.

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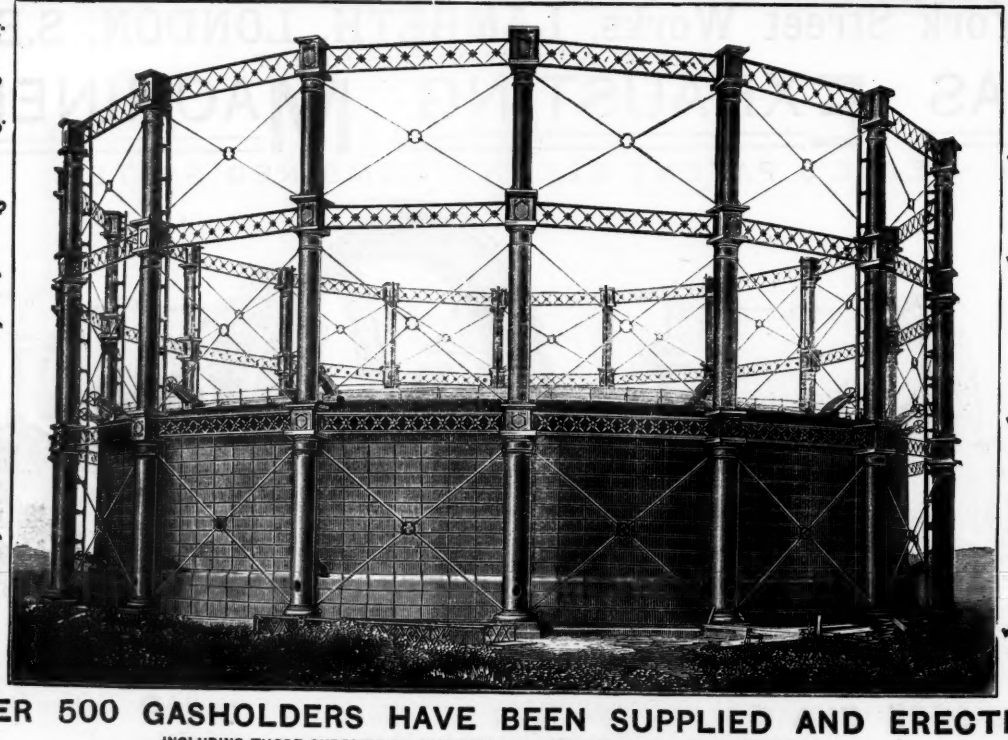
GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS, RETORT FITTINGS, ETC.



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INCLUDING THOSE SUPPLIED TO THE FOLLOWING GAS COMPANIES AND CORPORATIONS:

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BECKTON.	BRADFORD.	CARDIFF.	LEEDS.	NOTTINGHAM.	RIO GRANDE.	SYDNEY.
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449 Patent "Standard" Washer-Scrubbers,

Capable of extracting the whole of the Ammonia from 426,560,000 Cubic Feet of Gas per 24 hours,

Erected and in course of construction at present date.

The following List comprises the orders received for Improved PATENT "STANDARD" WASHER-SCRUBBERS constructed according to the Company's latest patent, and Renewals effected by the application of same to old pattern Machines.

IMPROVED PATENT "STANDARD" WASHER-SCRUBBERS.

Birmingham	5,000,000	Kilmarnock	1,000,000	Lyons-Vaise (France)	525,000
Beckton	3,500,000	Dover	1,000,000	Barry and Cadoxton	500,000
,,	3,500,000	Colchester	1,000,000	Workington	500,000
Kensal Green	3,000,000	Cambridge	1,000,000	Lowestoft	500,000
,,	3,000,000	West Bromwich	1,000,000	Newton-le-Willows	500,000
Liverpool	3,000,000	Luton	1,000,000	Manchester	400,000
,,	3,000,000	Alger (Algieria)	875,000	Erfurt (Germany)	400,000
Croydon	3,000,000	Valencia (Spain)	875,000	St. Chamond (France)	350,000
West Ham	3,000,000	Barcelona (Spain)	875,000	Santander (Spain)	350,000
Rochdale	3,000,000	Nice (France)	875,000	Atlas Steel Works, Sheffield	250,000
Paris	3,000,000	Stockport	800,000	Bangor	250,000
,,	3,000,000	Magdeburg (Germany)	750,000	Lille (France)	250,000
Glasgow	2,500,000	Altoona (U.S.A.)	750,000	Melun ,,	210,000
,,	2,500,000	Smethwick	750,000	Valencia (Spain)	200,000
Manchester	2,500,000	Schneider-Creusot Works		,, ,,	200,000
Leicester	2,250,000	(France)	735,000	Vercelli (Italy)	200,000
Swansea	2,000,000	Valparaiso (Chili)	600,000	Rawmarsh	200,000
Bordeaux	2,000,000	Halle (Germany)	600,000	Baccarat (France)	175,000
Melbourne	1,500,000	Elberfeld ,,	600,000	Hitchin	150,000
Charlottenburg (Germany)	1,500,000	,, ,,	600,000	Sydney	100,000
Derby	1,500,000	Nancy (France)	525,000	Balson-Chateauroux (France)	70,000
,,	1,000,000	,, ,,	525,000		

RENEWALS

Birmingham	5,000,000	Hastings	1,500,000	Heckmondwike	500,000
Nine Elms (in part)	3,000,000	West Ham	1,500,000	Hampton Wick	500,000
Vauxhall ,,	3,000,000	Nottingham	1,500,000	Kingston-on-Hull	400,000
Dublin	3,000,000	Melbourne	1,500,000	Weston-super-Mare (in part)	400,000
Shoreditch (in part)	2,500,000	,,	1,500,000	Enfield	300,000
Beckton	2,500,000	Crewe (L. & N.W.R. Co.)	1,250,000	Harrow	250,000
Manchester	2,500,000	Beckton	1,250,000	Buxton	250,000
Bromley	2,000,000	,, (in part)	1,250,000	Quebec, Canada (in part)	250,000
Pimlico (in part)	2,000,000	Bradford	1,250,000	Newmarket	150,000
Plymouth	2,000,000	Maidstone	1,000,000	Leominster	150,000
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All New Patent "Standard" Washer-Scrubbers are fitted with the Company's Patent Improved Wooden "Bundles" or Washing Devices, which can be readily fitted to old pattern Machines.

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W. & B. COWAN'S DRY METERS.

These, which are made at our Factories in London, Manchester, and Edinburgh, are constructed of the best charcoal double tinned plates, and the diaphragms of the best Persian sheepskins specially selected and prepared. The diaphragm is tied with Bessemer steel wire, between which and the leather a band of flax webbing is interposed, so as to protect the latter. By this means leakage at the tying is rendered impossible.

Leakage at the index-box is effectually prevented by the adoption of a grease-cup in connection with the ordinary stuffing-box. A prolonged experience of this modification, which we introduced in 1878, justifies its recommendation as a substantial improvement.

Excepting as regards the cases, the above remarks apply equally to our cast-iron cased Dry Meters, which are found very useful for certain special purposes.

All the sizes of these Meters are of neat design, and are unexcelled for workmanship, material, and finish. The most careful supervision is exercised at every stage of their manufacture, and only the highest class of skilled labour is employed.

Meter in Tinplate Case.

Meter in Cast-Iron Case.

Large Stocks always Ready for Immediate Delivery or for Shipment.

W. & B. COWAN,

ESTABLISHED 1827

SMITH SQUARE WORKS, WESTMINSTER, **LONDON, S.W.** TELEPHONE No. 3250. "DISC LONDON."

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W. & B. COWAN'S DRY METERS.

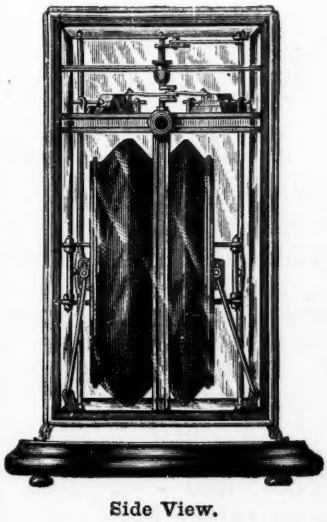
Outside Dimensions.

Size.	Depth, Back to Front.	Height, including Unions.	Width, including Unions.
Lights.	Inches.	Inches.	Inches.
2	7¼	13¾	10
3	8⅝	15	11¼
5	9½	16¾	13
10	10¾	19	15
20	13¼	24½	18½
30	16⅛	27½	21¼
50	20¼	33¼	26
60	21	33½	27
80	24¼	40½	31
100	25½	42¼	33¼
150	27¾	50¾	42
200	30	56¾	42¾
250	34¼	58	46¼
300	38¼	63¼	49¼
400	41¾	72¼	56¼
500	46	74	57½
600	47½	76	59½
800	50	83	63
1000	52½	86	67

Design for 150 Lights and Larger Sizes.

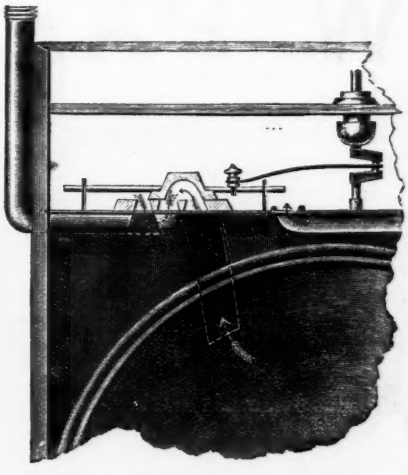
Measuring Capacity.

Size.	Bore of Inlet and Outlet.	Per Revolution.	Per Hour.
Lights.	Inches.	Cub. Ft.	Cub. Ft.
2	½	0·083	12
3	⅝	0·125	18
5	¾	0·160	30
10	1	0·3	60
20	1¼	0·5	120
30	1⅜	0·830	180
50	1½	1·428	300
60	1¾	1·6	360
80	2	2·5	480
100	2	2·857	600
150	3	5·0	900
200	3½	6·6	1200
250	3½	7·3	1500
300	4	8·3	1800
400	5	12·0	2400
500	5	14·285	3000
600	5½	16·0	3600
800	6	22·0	4800
1000	8	28·0	6000



Side View.

Front View.



Section of Valve and Gas Passages.

W. & B. COWAN,

ESTABLISHED 1827

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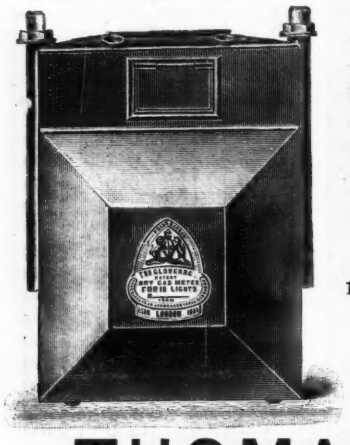
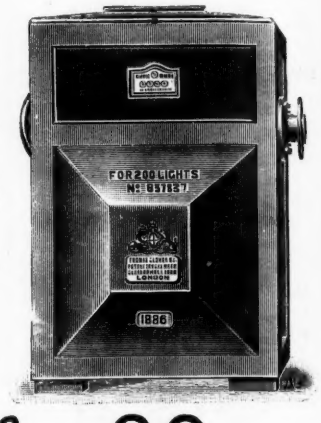


1st.—Are a remedy for all the defects of Wet Meters.
2nd.—Are suitable for all Climates, whether hot or cold.
3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe.
5th.—Are the most accurate and unvarying measurers of Gas.
6th.—Prevent jumping or unexpected extinction of the Lights.
7th.—May be fixed either above or below the level of the Lights.
8th.—Cannot be tampered with without visibly damaging the outer case.
9th.—Will last much longer than Wet Meters.
10th.—Will not cost more than one-half for repair that Wet or Water Meters do.
Are upheld for five years without charge.



Telegraphic Address: "GOTHIC LONDON."
Telephone No. 6725.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

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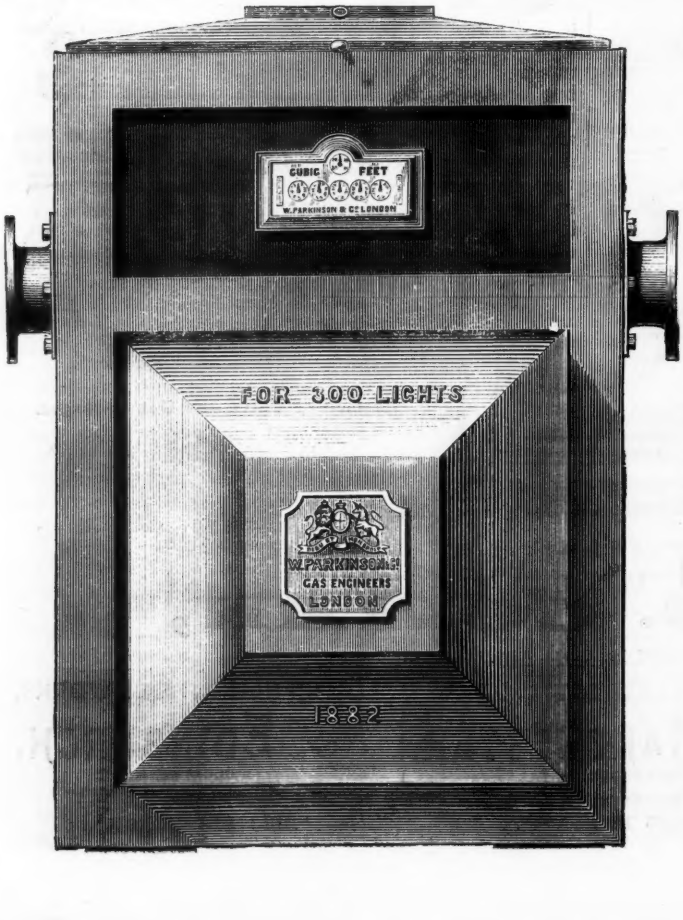
W. PARKINSON & Co.



MANUFACTURERS OF

DRY METERS

OF THE VERY BEST QUALITY.

The DIAPHRAGMS are of the Finest PERSIAN SHEEP SKINS.

The CASES are of the Best CHARCOAL-TINNED PLATES.

WET METERS,

With PATENT THREE-PARTITION DRUMS.

STATION METERS AND GOVERNORS,
PRESSURE & EXHAUST REGISTERS,
MOTIVE POWER METERS,
Test Gasholders, Experimental Apparatus, &c.
PRESSURE GAUGES OF EVERY DESCRIPTION.

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TO CORRESPONDENTS.

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THE
JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 14, 1892.

The Gas Industry before the Labour Commission.

In another part of the present issue will be found the remainder of the evidence relating to the conditions of labour in the gas industry given before the Labour Commission by Mr. G. Livesey, Mr. G. C. Trewby, and others. Our comment upon this evidence last week left off with Mr. W. A. Valon's testimony; but we also reported the evidence of Mr. T. Duxbury, of the Darwen Corporation Gas-Works, and Mr. H. E. Jones, of the Commercial Gas Company. Mr. Duxbury's story was not long; but it was brilliantly illustrative of the practical reliance upon lawlessness and violence of the New Unionists. Mr. Jones's statement was full of strong interest, albeit not of the kind which the witness would probably have preferred. He had to tell how the coal porters did what they pleased with the Commercial Gas Company, from the period of Sir John Lubbock's farcical "arbitration" on the claims put forward by Michael Henry downwards. It does not appear from Mr. Jones's story that the policy of giving way in everything, presumably for the sake of a quiet life, has served the Commercial Company very well, since their Union coalies seem very ready to strike, so to speak, "at large," or whenever the humour suits them. The extravagant wages they receive probably accounts for this skittishness. Like many another man, the average coalie "cannot carry corn." To Mr. George Livesey the witness had to confess that he "was afraid" to do a variety of things which might have upset the unionist stokers. It is always pleasantest to suppose, when one see things going on differently in different gas-works, that every manager knows his own business best. There was doubtless a plausible case to be made out at the time for the abandonment of the South Metropolitan interests at the Mansion House conference, at the bidding of the now notorious Michael Henry, and for trusting in the "sweet reasonableness" of the Trade Union leaders, who confess that they are frequently powerless to control their men, and are as often mistaken in their counsels; but the result of taking this course, in the experience of the Commercial Gas Company, does not make a very attractive picture as it was unfolded before the Commission.

Next came Mr. G. C. Trewby, who made a brave showing of the size and condition of the industrial army in the pay of The Gaslight and Coke Company. He soon had to tell the Commission of the occurrence of labour troubles at Beckton, however, even after the Company had freely conceded the eight-hour shift desired by the Union, at a cost to the undertaking of £70,000 per annum. The first serious affair of the kind was over the introduction of labour-saving stoking machinery, when 61 men in the employ of the contractors had to be protected by a body of 34 police against the violence of the other men. Mr. Trewby drew a marked distinction between the working of the older Trade Unions with which he has had to deal (such as the Engineers and Boiler Makers) and the Gas Workers' Union, which set up to be nothing else than a "fighting "body." With much quiet force, the witness remarked that this particular Union is more endurable now, because many of the members have left it. It is necessary, in connection with a portion of Mr. Trewby's evidence, and certain passages between him and the Chairman of the Section, to lay some stress upon the point of the much-debated question as to whether the law is strong enough to meet the eventuality of gas stokers breaking their legal notices *en masse*. Mr. Mundella seems to think that the terms of the Conspiracy Act are sufficient in this regard; but Mr. Thorne has not hesitated to express his conviction that gas stokers should set the Act at defiance, when there are enough of them in the same boat, upon the ground that it would be practically impossible to imprison from 2000 to 5000 men at once. We hold that, having regard to human nature, which does not grow stiffer in the backbone with advancing years, Mr. Thorne's view of the matter is shrewder than Mr. Mundella's. London gas managers declare, moreover, that the Act is, to all intents and purposes, a dead letter as regards the very men against whom it would be first set in motion, because such men have no permanent address, and the police could never catch them. But when the police have caught them, what then? It is idle to pretend that what can be done with five men can be done equally well with five thousand. Logically or not, the public mind is swayed by the idea of numbers. If a single holiday-maker at this last Whitsuntide had fallen overboard from an excursion steamer, there would have been an end of him. The community would not have shivered over his fate, nor have provided a penny for his family, supposing these to exist and to have been left destitute. But multiply that imaginary sufferer by five hundred, and what would have been the result? There would be a Mansion House Fund, and all the rest of it; although the need of the individual victims would be no more severe than if there had been no such multiplication. It is the same even with cases of admitted law-breaking. The solitary murderous poacher, when caught, gets his punishment, and nobody sympathizes with his fate; but let there be half-a-dozen of him, and straightway our emotionalists begin to cry out about the iniquitous wholesale sacrifice of men to the "cult of the "sacred birds." So it would be with the gas stokers. Knowing, as we say, the times we live in, it is inconceivable

that any Magistrate would sentence 2000 or 5000 men in a batch to three months' imprisonment, with or without hard labour, or that such a sentence would be enforced.

Mr. Livesey's evidence was very full, as was to have been expected. He gave the first taste of his quality by demolishing the claim of the Socialists and Trade Unionists to the invention of the eight-hour shift; and he then proceeded to show, from the books of the South Metropolitan Gas Company, how the wages paid to workmen have risen during the last fifty years. He told the Commission how the conditions of employment under that Company altered from time to time; and then, on the special invitation of the Chairman to "tell them all about "1889," Mr. Livesey gave the history of that eventful period, when the South Metropolitan Company stemmed the flowing tide of the New Unionism. He also cleared up many matters that have hitherto remained in obscurity. Among other details, he explained the origin of the historical threat, ascribed to him by labour agitators ever since, of "smashing the Union," and narrated, in simple, graphic language, how it came to be a question of who was to manage the Company's works, and how the Directors and their officers contrived to retain the control of their own business. The practical working of the "Federation "of Labour" was illustrated by Mr. Livesey's statements of how the coal porters abandoned the Company's wharves, how the lightermen left the contractors' barges, and how the Seamen and Firemen's Union boycotted the Company's vessels. The works were "picketed"—to give it the legal term—by thousands of the Company's enemies; and before the Directors saw the end of the conflict, they had paid £100,000 for the defence of their position. "Was the "result worth the cost and trouble?" Mr. Livesey was asked. His reply was, "Unquestionably." The whole of his answer to this inquiry deserves to be given. "It checked, from that day to this, for all the gas "undertakings in the kingdom, the further aggressions of "the Gas Workers' Union, one of which would have been "the additional shilling a day, or another 20 per cent. on "wages, equal in our own case alone to some £20,000 a "year. But this was the smallest part of the gain—it "broke down a system of tyranny over employers and "employed that had become intolerable. Even that is "not the greatest advantage—it gave, in place of hostility "and antagonism, peace and goodwill; in place of doubt "and mistrust, confidence; and in place of sullen and "discontented workmen, a body of cheerful, willing, and "capable workers, with whom it is a pleasure to be asso-"ciated." Mr. Livesey's evidence, reinforced as it was by the facts and figures which the Chairman of the South Metropolitan Company has ever at his fingers' ends, made an evident impression upon the Commission. He was not cross-examined, even by the Labour members; and no attempt was made to shake the main edifice of his testimony—nobody being able to defend the principles and practices of the Social Democratic bodies whose growing power for evil was wrecked upon the South Metropolitan Company's splendid combative organization.

Last Week's Doings.

Once more it has happened that, while the Labour Commission was collecting materials for a history of the agitated times from 1888 to 1890, history was being made out of doors by acting representatives of employers and employed. Several things were going on last week which observers of labour matters could hardly fail to find very interesting. There was the International Miners' Conference in London, the Co-operative Union Congress at Rochdale, and the meeting of the delegates of the Amalgamated Engineers in Leeds; to say nothing of the annual performance of the Gas Workers, at Plymouth. Of greater practical importance than any of these gatherings, moreover, was the conference between the masters and men engaged in the London building trade, which resulted in an amicable settlement of differences that might easily have issued in a most serious strike. This incident of contemporary history is of peculiar interest by reason of the light it throws upon the talk about Boards of Arbitration or Conciliation, which is now-a-days so much indulged in by all sorts of people. Mr. Joseph Chamberlain, in the course of his speech at Smethwick, said something about this device for the prevention of strikes. Like everybody else, Mr. Chamberlain is shocked at the occurrence of such reproaches to civilization and common sense as the Durham strike; and he expresses the confident belief that if there were Arbitration Boards duly constituted for taking cognizance of labour disputes, and pronouncing judgment upon the rights of every disagreement of the kind that had such deplorable results in Durham, the decisions of these tribunals would so influence public opinion as to ensure their own validity, even without means for imposing a distasteful judgment upon the defeated party. This might, and probably would, be so in cases where the dispute was a *bonâ fide* one, as between men of business anxious to come to such terms as would enable work to be properly carried on. But where men's passions had been roused, or their minds had been played upon by professional agitators with interests of their own for prolonging a strike, there are only too many examples, like those of the Durham miners and the Tyneside fitters, to show that public opinion can be defied by strikers quite long enough to enable infinite mischief to be done. This consideration, however, leads to the reflection that where, as in the case of the London building trades' dispute, there is real anxiety for a settlement, and where agitators are kept out, and none but practical men have a hand in the affair, there is no need for any tribunal, other than such as the existing organizations of masters and men can create at will, to formulate an authoritative decision. The most important point in the new settlement for the building trades is the establishment of a week of 50 hours as full time for summer; for, as in regard to the Saturday half holiday, what is law for the builders now will probably soon extend to other trades. This peaceful conclusion of a dispute involving the length of the working week will do more to knock the "Legal Eight-Hour Day" nonsense on the head than any amount of argument. For, seeing that the building trades have arrived by consent at a working week of 50 hours, it is absurd to pretend that an Act of Parliament is needed to get the two hours which differentiate this period from the magic figure beloved of Socialist agitators.

It must be growing apparent to the Burns and Mann clique that the workers for whom they have posed as leaders and spokesmen are "going to do without them," as a song, also once popular, has it. They were not asked to place their exceptional talents at the service of the builders' men; and the Amalgamated Engineers, not content with passing over Tom Mann for the coveted berth of General Secretary of the Society, did not even send either him or Burns to Leeds to help in the serious work of revising the rules. Indeed, the President of the delegates' meeting (Mr. A. B. Childerson) is one of those old-fashioned trade unionists at whom the self-appointed leaders of the New Unionism used to laugh a year or so ago. He "does not believe in street processions, or bands "and banners. Likes the old methods best. Is of a "pacific disposition. Does not look upon an employer as "a natural enemy, but as a man to be dealt with on equal "terms." We are also informed that this reactionary leader is opposed to flaunting Trade Unionism in the streets, and has great faith in the moral force of a big balance at the Society's bankers when the men come to argue with their employers. All this—especially the "big "balance"—is so utterly foreign to the spirit of the New Unionism, that if the policy represented at Leeds by Mr. Childerson is to prevail with the Amalgamated Engineers, it is clear that New Unionists must betake themselves to more congenial company, such as the Seamen and Firemen, or the Dockers.

The International Miners did little at their meeting besides squabble in three languages over the curious point as to whether the Legal Eight-Hour Day should apply only to the underground men or should embrace the surface workers also. The English members of the congress saw practical difficulties in applying the rule to all workers in and about mines; but this regard for facts was little to the taste of the philosophical Germans and logical Frenchmen, who would not hear of any invidious distinction being drawn between the rights of the different orders of mine workers. Seeing that there is a long way to go yet before anybody will have his working time cut down by law to eight hours, this polyglot dispute strikes an observer as being another example of "much ado "about nothing." The same remark, by the way, applies with equal force to the Plymouth performance of the (nominal) Gas Workers, represented upon this occasion chiefly by the queer Aveling family.

A Daring Questioner.

Once upon a time, an enthusiastic gentleman who felt constrained by Destiny to assume charge of the policy of the London County Council, took the trouble to compile a book to which he gave the name of "The London Pro-"gramme." In this modest work he set forth a scheme of municipal aggression which could only have a logical end in the local authority undertaking to "do for" the rate-payers, out of the rates, in respect of everything that humanity has need for, from the cradle to the grave. The progressive Londoner was to look to Glasgow, Manchester, Birmingham, and even, as we seem to remember, to Paris, for examples of what the spirit of municipalization can do when permitted a "free hand;" and he was to insist upon doing likewise in London—only more so. It has always struck us as a remarkable circumstance, that when our uncompromising worshippers of what they call the "Spirit "of Democracy" wish to impress the British people with a full sense of the all-sufficiency of various democratic nostrums for removing all the ills that afflict towns-people living under our admittedly imperfect social and political systems, they shun all reference to the land which, one would think, need only to be cited to prove their case. We mean, of course, the United States of America. Here there is, and has been for years, manhood suffrage, with one vote per man, a very elaborate Federal constitution, and all sorts of modern conveniences of the same character; but, somehow, our Progressists do not care to talk about the condition of the cities of the States. Why is this? Well, an explanation, if but a partial one, may perhaps be found in a curious paper contributed by Mr. William Nelson Black to the April number of the American *Engineering Magazine*. To the ardent believer in Municipalism for its own sake, this plain-spoken statement must come as a severe shock. For in it he will find the author asking whether it is "expedient to put any kind of productive work in the "hands of municipalities," and answering the question with a decided negative. Of course, the ingenious American writer puts the municipality, as an institution, among those bad things which the free American people inherited from the Old World. The remarkable thing is that Mr. Black paints the municipality *per se* in the colour after which he is himself named. He goes on to show, much to his own satisfaction, that the Municipalities of the United States, and particularly that of New York, have shamefully mismanaged the public business, and he wishes to do away with everything of the kind, and put not only gas and water supply, but also drainage, paving, town and river-side improvement, bridge-building, and in short every local requirement down to school provision and management, into the hands of companies, who might be depended upon to do their work under economic conditions. His thesis is simply this: "The municipality is unneces-"sary; it is, moreover, industrially inefficient and "politically corrupt; and there is no reason for its con-"tinued existence." One can easily imagine the hair of the author of the "London Programme" rising in horror at this denunciation of the idea of Municipalism arising from the midst of the most democratic community in Christendom. But what is to be said about it? We have been so habituated of late years to the ravings of self-styled reformers who have told us that local authorities "ought" to supply their districts with gas, water, electric lighting, tramways, and many other services which were once thought to fall within the scope of private enterprise, that some of us have begun to tacitly accept the assertion as indisputable. But here is a bold man who, having seen how things work, asks: "Why should a ring of gerry-"mandering politicians be permitted to take a shilling "out of the pockets of the people, in the name of the "'Municipality,' for doing something that any commer-"cial firm would do better for sixpence?" The query is an awkward one, to say no more.

Masonic.—We have much pleasure in announcing that Earl Amherst has appointed W. Bro. W. A. Valon to the Junior Wardenship of the Provincial Grand Lodge of Kent; and he will be installed in this office at Ramsgate on the 24th inst.

The Judgment in the Gasholder Guiding Patents Case.—We learn that Messrs. Gadd and Mason have given instructions for notice to be filed of appeal against the judgment of Mr. Justice Kekewich in the action brought by them against the Manchester Corporation—see Journal for the 31st ult. (p. 1017).

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE TWENTY-NINTH ANNUAL GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS, June 14, 15, & 16, 1892.

Mr. W. A. Valon, Assoc.M.Inst.C.E., President.

INAUGURAL ADDRESS.

Gentlemen,—In approaching the at once pleasurable but anxious task of selecting a few thoughts for your acceptance, it was early apparent that it was necessary to move an enormous mass of raw material, to make an insignificant collection. The mountain, viewed from a distance, conveyed no true conception of its magnitude; but when well under its shadow, the true proportions were clearly discernible. Thus it was slowly realized what needed to be penetrated before success could be hoped for, in the endeavour to extract something worthy of critical eyes, however indulgent.

The Council's Report.*

The report of the Council need only be enlarged upon to notice rather more at length the untimely removal from our midst of more than one familiar face—among them, Josiah Deakes, of Worcester; also Mr. W. H. Bennett, of London, who until 1888 held the post of Secretary to this Institute. Those who, like myself, had the advantage of his friendship for many years, will recognize the gap that is left by his death. Mr. George Shepard Page, of New York, was also very suddenly removed. Only a day or two before the public announcement of his demise, a letter came to me from him which bore no trace of the coming event. His kindly manner, with a distinct personality, will be long remembered by all the members of this Institute; and his personal friends on this side will continue to bear in mind a genial man of a warm and attractive temperament. We have also the misfortune to record on the death-roll the name of a Past-President of this Institute, Mr. Robert Harris. In 1884, he sat in the chair now occupied by me; and by his decease, I lose a friend. He was a member of the Institution of Civil Engineers; and at the time of his being finally laid aside by illness, he was a Vice-President of the Society of Engineers. We may conscientiously refer to him as a gentleman of unassuming demeanour, ever ready to do a kindly action, lend a helping hand, or impart information which he himself must have acquired at considerable sacrifice. He was a good man of sterling value; and we can now only rise in our places as a tribute of respect to the man and the office he once held.

The World's Fair in America in 1893.

The great exhibition to be held at Chicago in the coming year, deserves mention as an event which will probably have a tendency to bring the claim of gas to its proper position as a lighting and heating agent in competition with other systems—notably electricity. Opposition through prejudice could scarcely have reached further than was shown by the authorities who had the granting of space in and about the building for exhibition purposes. For a considerable time, it was doubtful if gas exhibits would obtain any place in the great show. Nothing daunted, however, by obstacles, a syndicate of gentlemen was formed, with Mr. Alex. C. Humphreys as Secretary and Chairman of the Finance Committee, who rendered it certain by their energy and perseverance that the great American Gas Industry should be suitably represented in a building erected independently for that purpose.

It is intended that foreign exhibitors shall have as favourable positions as possible assigned to them; and it is hoped that any of our Members who can, will apply for space for apparatus, so that the British exhibits may not be the least interesting in the building. The Gas Industry Council of America intend to provide and maintain exhibits covering all points which cannot be looked for from individual exhibitors—such as historical exhibits, showing the development of the industry; advanced forms of construction,

* The principal matters dealt with in the report are noticed on p. 1112

including combination of lighting and ventilating, application of gas-engines for pumping, the working of elevators, and other engineering requirements, special installations of high candle power lighting; and demonstrations of the value of gas as a light of luxury and convenience as well as the light of the million. Opportunity will thus be afforded to all professional visitors to become acquainted with the progress made in the industry up to date, covering work done in all the countries of the world, which means that gas engineers visiting the exhibition will obtain information, in as many directions as they would otherwise obtain by months of travel among gas companies and manufacturing firms. I hope to meet a goodly representation from this Institute in Chicago next year; and in the name of the genial and clever Secretary of the Gas Industry Council of America, I promise you a warm welcome.

General Progress in Gas Manufacture and Consumption.

At times, some of us have stated that the manufacture of gas has improved but little since its early days; and as a result, this has been persistently repeated by outsiders. This fallacy was easily and ably refuted by our immediate Past-President, in some of the remarks contained in his address delivered last year at Carlisle. True progress is rarely progress by events. The so-called great discoveries are apt to reckon very little in the sum of our experiences; it is the aggregate of small events which are alone truly formulative in the contribution to the total of our general knowledge. Countless small improvements have by degrees led up to a state of perfection in our manufacturing processes, seen but dimly, if at all, by the original discoverers and founders of our great industry. The strides which we have made must be judged by a survey of the progress of a period. The true test of that progress is the feeling that from time to time advancement has been surely made, rather than by the evidence of any great innovation that will bear enumeration and measurement. Therefore, it happens that, while running our eyes over the events of the past year, we see nothing that stands out prominently as the immediate product of the time intervening since our last meeting; yet there remains in the mind a feeling of satisfaction, that steady advancement has been made.

In the manufacture of gas, advancement seems to have shown itself principally: First, in the more general adoption of some method of drawing and charging retorts by machinery; and, secondly, in efforts to improve the method of purification. In distribution, the advance has been made in endeavours to improve the method of consuming gas.

Machinery.

Much has been said and written on the subject of machinery during the past year; but, having due regard to the importance of the matter, certainly not too much. This subject divides itself under three heads: (1) Machinery for horizontal retorts; (2) machinery for sloping retorts; and (3) labour-saving machinery, as applied to every part of a gas-works.

For a considerable time past, machinery for horizontal retorts, sloping retorts, and labour-saving machinery as applied to all parts of a works, has occupied the serious attention of some members of the gas profession, and has been as persistently treated with indifference by others. The moment has, however, arrived when all must give the question careful study in one form or another. Many forms of machines have from time to time been under our consideration. They are all well known by the names of the makers, and need not be mentioned in greater detail. Many of those introduced had some excellences; some, many defects. The machines now existing and competing for favour are limited; but it naturally follows that they are more efficient. By this, it is not meant to imply that perfection has been reached. There is much room for improvement; and it is not certain that better machines than have yet been seen, do not remain to be devised. They have, however, now reached such a stage of development that there is no reason why one form or another should not be freely introduced into every works; and one cannot help thinking that, in the light of present experience, the engineer who neglects the introduction of appropriate machinery into the retort-house, and every other department of his works where it can be economically used, is casting upon himself a heavy responsibility, that neither need, nor should be borne. The machines, to be useful, should be simple in construction; easy to work and maintain; all working parts should be in duplicate; and, while possessing the maximum of efficiency, the machines should only require the minimum of ordinary labour, and be as little dependent as possible on skilled workmen for their repair, maintenance, and manipulation.

Hydraulic Mains, &c.

The retort-house of to-day may have the outside and inside appearance of half a century ago; but, in reality, it bears the unmistakeable stamp of accumulated experience, gained in a great degree through the knowledge made available by the mutual interchange of thought and description of methods imparted to the members through the agency of this Institute. Turn for a moment to the Proceedings of 1872, when Mr. Livesey read his paper on "Hydraulic Mains," and note the remarks of the various speakers, some of them representative men. The current knowledge of the day may be fairly gauged. Now, the division of the tar and liquor, on which so much depends, is clearly understood, and well disposed of. The anti-dip, as an extreme measure, struck the light by which we saw the happy medium of a reduced liquor seal. Self-sealing lids, screened foul mains, and last, but not least, gaseous firing, have all contributed their quota to the general advancement. "Authority," which dogmatically asserted a balance of good by the use of an exhauster so long as the exhaust maintained in the hydraulic main equalled the pressure thrown on the retorts by the seal of the dip in use, is now a thing of the past.

Gaseous Firing.

A few words on gaseous firing may be useful, although most of you are probably acquainted with past work in this direction. Gaseous firing, thanks greatly to the independentline taken up by our leading technical journal, is better understood now by the profession than it would otherwise have been for a generation or more to come. Many papers have been read and discussed at intervals, since my experience was laid before the Institute in 1882 and 1884. The principle sought and fought for in those papers has prevailed. Practice has confirmed the lessons then taught, and clearly established the lines on which we can work with advantage. Many interesting contributions from men of observation have been added to our Transactions since the date named. All, however, tend to greater simplicity; the last, but not the least important, word having been spoken on the subject by our friend Mr. W. R. Chester, of Nottingham, at the Manchester District Institution last year.

The following may be suggested as an accompaniment to a good arrangement for economical heating: (1) Sufficient depth of furnace; the failure to obtain which from any cause, either structural or financial, is a mistake. (2) The greatest possible simplicity in construction. (3) Controlled air supply, both primary and secondary; no more being admitted than is absolutely required for perfect combustion. (4) Only sufficient heating surface to raise the temperature of the secondary air supply to as nearly as may be the temperature of the combustible gases at the point of ignition. (5) Let the heat generated be distributed equally throughout the setting. This does not mean dividing the initial flame into small jets—indeed, that is a mistake, and should, as far as practicable, be avoided. (6) Use steam as well as water for producing the moisture necessary for preserving the brickwork and fire-bars where these are used. (7) Let each setting have its own furnace, controlled by its own chimney. An outside producer, or a furnace arranged to supply more than one setting, is less economical in fuel, and more expensive structurally, if maintenance be taken into consideration.

Sloping Retorts.

At the present moment, one is hardly prepared to class sloping retorts as an improvement on the present mode of setting them horizontally; nor at the same time need a final judgment be given with regard to them, as it is impossible to tell what may be reserved for the future, although the results hitherto obtained have been disappointing. In a degree, this may be accounted for by the extravagant promises made by those introducing the system; the great expectations raised not having yet been realized. Nothing appeals more to the desires of a gas manager than a self-discharging and, if possible, a self-charging retort. Any arrangement promising this longed-for improvement will be sure to secure immediate attention. Hunger is not dainty, and takes all food until the

craving is satisfied. From observation, we are forced to the conclusion that we have expected too much from inclined retorts. The gain, either in labour, machinery, or comfort, is at present doubtful; while the increase of cost for construction and maintenance is certain.

Purification, Condensing, and Separating.

As purification begins in the hydraulic main, the gas from this point until it leaves the washer needs as much care, knowledge, and attention as at any period during its progress to the gasholder. A condenser has the twofold duty to perform of removing the tar and reducing the temperature. The first should be done as quickly as possible; the second, as gradually. Now, as the tar is mechanically suspended in more or less minute globules in the crude gas, it is necessary that these globules should be brought into contact with each other, or some hard substance with a velocity sufficient to cause their collapse. This process should be concluded as speedily as possible, while the gas is still hot; and the initial temperature can be maintained as high as is necessary by jacketing the pipes with non-conducting material. But close observation has shown that, to maintain the temperature by the use of steam introduced in any manner, no matter how carefully it may be handled, will not result in good—indeed, it must be so, as a second distillation on a totally different basis is naturally set up, and the two processes cannot go on harmoniously together. No doubt, if practicable, cooling the gas should not commence until all the tar has been deposited; but as this is at present unattainable, let us get as near perfection as we can. The question of condensation was in 1882 made a special subject of inquiry by the Institute, and greater uniformity of condensing arrangements might reasonably have been expected to commence from that date; but nothing strikes an observer more than the diversity in pattern of the apparatus employed to prepare the gas for the removal of the ammonia.

Washing.

The succeeding operation of washing is not likely to fail for want of efficiency. The apparatus now employed takes many different forms. Some may be more economical than others from a structural point of view or in after manipulation; but all do their work well—indeed, in most cases too well. More damage is done than is generally supposed by over-washing. Care should therefore be taken to guard against this extreme, so that the illuminating power may not suffer, as well as to avoid its after-influence during the process of removing sulphur. Some time since, experiments were made by Mr. C. F. Goodno, of Dedham, Mass., on the effect of condensation and washing on the illuminating power of gas. These were undertaken from the knowledge that a very minute variation in the percentage of absorbable hydrocarbons by volume is sufficient to materially influence the illuminating power. In view of the general opinion that lime in the purifiers absorbed hydrocarbons from the gas, a number of trials were made by passing gas through a layer of oxide or a layer of lime, each about 12 inches thick; an examination of the gas being made for hydrocarbons, by means of "Hempel's" apparatus, before and after treatment. The result of nine separate experiments was to show that the percentage of absorbable hydrocarbons was not reduced by passing through lime or oxide. The gas was next examined in a similar manner as to the effect of the passage through a pipe condenser and a washer, consisting of a rectangular iron box with alternate shelves, supplied with 4 to 5 gallons of fresh water per 1000 cubic feet of gas passed. The average of five experiments gave a loss of hydrocarbons to the extent of 0·36 per cent. These results were so striking that, for satisfaction, the experiments were retried at my own works, the effects being fully borne out. While trying these experiments, an important light was thrown on the influence in after-purification of over-washing the gas; and continued trials and many observations enabled me to fix what in my mind should be the end of the duty of the washer and scrubber. It is not wise to push washing and scrubbing to the point of perfectly clean water, or to eliminate the last traces of free ammonia from the gas before passing it on to the lime boxes, or lime and oxide boxes, as the case may be; for it may be presumed that we have all, without exception, advanced to the position that purification dependent upon oxide without a due proportion of lime, is indefensible, as being incomplete and extravagant. A series of experiments, made with a controllable scrubber, showed that the illuminating power of the gas suffered by the removal of the whole of the free ammonia in such a manner as to reserve a last chamber of clean water at the outlet of the scrubber. A second chamber of clean water accentuated the evil; the reduction of illuminating power being measured as ranging between 3·3 and 7 per cent. Continued trials further demonstrated that clean water freely applied reduced the lighting power to an alarming extent; and so it became important to determine in practice the point to which washing should be carried. This point is reached when the gas leaving the scrubbers contains from 4 to 6 grains of free ammonia in 100 cubic feet. The value of this ammonia, if extracted, is insignificant. It is not my intention to enter into or notice what should now be regarded as old methods of purification; they should be considered obsolete, and observed from an historical point of view only.

The two systems holding the field are the Claus ammonia process, and the oxygen process—the so-called "air arrangement" being an offshoot of pure oxygen.

The Claus Process.

When in Belfast, attending the meeting of the North of Ireland Gas Managers' Association, an opportunity was afforded me of examining the Claus process, although not in use at the time, the pumps having been stopped for repair owing to the great difficulty of keeping the rods and stuffing-boxes sound, due to the natural action of ammonia on metal. From this cause, the loss of ammonia was so large as to reduce the available quantity below that required for complete purification. The pump difficulty, in conjunction with the waste of ammonia, which rapidly reduces the quantity below what is required for continued purification, has hitherto been the great drawback to a very fascinating system—one from which, it must be confessed, we all had great expectations. But as difficulties are seldom insurmountable when seriously grappled with, we may hope to hear more of this truly scientific process in the future.

The Oxygen Process.

Personal experience of pure oxygen enables me to speak well of it. On more than one occasion, the result of my experience has been laid before the Institute; and from time to time additional facts, the results of further experience, have been communicated to the technical press, in order that it might be known if the data then relied upon had been established. In working this system, practical experience has ripened without in any way altering the facts as already stated.

Air.

The conflicting accounts given by users of air with lime or lime and oxide, render it extremely difficult to arrive at any definite conclusion with regard to its use. Since 1888, air seems to have behaved itself better than it did in days gone by; nor does it now, according to some experimentalists, depreciate the lighting power of hydrocarbon gas by admixture, as it used to do. In 1888, we hear of 2 per cent. of air being introduced into oxide of iron purifiers, without depreciating the illuminating power. In 1890, the percentage that could be safely used with lime was reported as increased to 4 per cent.; this quantity having practically no effect on the illuminating power, or at most, equal to 1-10th to 2-10ths of a candle. And it was stated that 3 per cent. improved the luminosity. In 1891, it was found, by a more careful observer, that 1 per cent. of air reduced the illuminating power 0·25 of a candle only; but as this result, even if correctly recorded, was gathered from experiments which were not on all-fours with those reported as applying to oxygen, they are of little or no value as a comparison. The trials referred to were made with an Argand chimney full of flame, without any regard to the arbitrary 5-feet burner, fixed by the Statute, and apart from the question of the most equitable test for lighting value.

It is but little comfort to the gas consumer, who, as a rule, burns his gas in small quantities, to be reminded that if he burns it in larger bulk, under certain conditions—whether he wants the extra light or not—he will obtain better results, as far as light for quantity is concerned. But according to the experiments of Dr. Schilling, made recently, and referred to later on, this hypothesis is also untenable. The point selected for the intake for air is sought to be made responsible for the divergence from well-ascertained data, with regard to the effect of nitrogen on the illuminating power. Be not deceived. It has been clearly proved that

nitrogen, mechanically introduced to coal gas at any point of the apparatus, during the ordinary process of distillation, cannot be made a carrier of hydrocarbons as far as the gasholder.

Dr. Schilling, in his paper read before the German Association of Gas Engineers (referred to in the JOURNAL OF GAS LIGHTING for Jan. 12, 1892, p. 65), gave the effect of air on illuminating power as follows :—

Per Cent.	With a Slit Burner. Depreciation.	With a Regenerative Burner. Depreciation.
2	14.5	16·7
4	26·8	25·8
6	37·6	35·3
8	48·2	47·8

Reduced to unit percentages, the slit burner gave a depreciation of from 6·02 to 7·25 per cent. per unit of air. The regenerative burner gave 5·88 to 8·35 per cent. The depreciation of illuminating power therefore ranged from 7 per cent. per unit for 2 per cent. of air, to 6 per cent. per unit for 8 per cent. of air. These experiments agree closely with my own made and published in 1888. But it is interesting to notice further, that the results recorded by Dr. Schilling are practically the same with the flat-flame burner as when consumed in bulk with the regenerative burner; but are in direct conflict with the statements made during the reading of the paper on "Purification" at the Institution of Gas Engineers in May, 1891, and prove the use of air to be unjustifiable and extravagant.

Here let me say it is my desire not on any account to be misunderstood. No accusation is made that gentlemen do not record what they regard as honest conclusions; but they may be either insufficiently informed, have founded their opinion on insufficient data, or may be liable to prejudices which may bias their judgment. Purification is no doubt better understood to-day than at any previous period of our history; nevertheless, much remains yet to be learned and applied. If all would do as they should to contribute their quota of experience to the general fund of information, with the single desire of arriving at the truth of certain principles, and would approach the subject with an endeavour to obtain complete, clear, and solid knowledge on which we may rely for the future, we should accomplish much, and succeed in dismissing error, which may be founded on insufficient data, and passes current principally on the very shifty ground of "Authority."

Care should be taken never to obtain knowledge in a slip-shod way. There is great danger of obtaining information, and deciding important questions right away, on what is called "Authority," without giving the necessary time for patient and impartial examination; hence, those who do this are either liable to be led astray by erroneous statements, or, by refusing to examine what is brought before them, are compelled to an opinion which they hope will find expression in some other quarter for which they will not be responsible but may safely quote. It is hard to most men to be rid of intuitional feeling, dangerous though it be. While there can be no royal road to knowledge, one may admit that many learned and scientific men, much to their annoyance, after years of thought, discussion, and research, have arrived at a conclusion which has already been in practice from sheer force of intuition. Still, even on that account, we should not advocate the doctrine of intuition. It is a dangerous one. Knowledge and judgment should alone be relied upon to guide; but, dangerous as this trust in intuition undoubtedly is, and disastrous as its record may be, it is not one whit worse than that of its rival "Authority." The man who is educated, is more likely to be wise than he who is not; but education and judgment by no means go together.

Let me conclude my remarks on purification by relating the experience which occurred while testing for illuminating power during the washing process already referred to. It may prove useful and will perhaps be of interest. It may be mentioned that it has been a habit for many years, while experimenting, to watch the effect of the experiments in other departments of the manufacture, as well as the one under immediate observation. In this way, it was found that free ammonia in the unpurified gas was not only necessary to maintain the illuminating power, but was an aid to after-purification. It is well known that, if every trace of free ammonia is removed before passing the gas through lime, the action of the lime will liberate the fixed ammonia; and although no free ammonia is at the inlet, free ammonia will appear at the outlet in larger quantities than is sometimes desirable. If oxygen be used, by leaving a little free ammonia to enter the lime purifiers, it will be found that the free ammonia at the outlet is less than when the gas enters entirely deleted, and further that the free ammonia and the ammonia freed by the lime entering into combination with the sulphur forming sulphide of ammonium aids greatly in keeping down the sulphur compounds.

Bye-Products. It is not my intention to dwell on the general question of our bye-products; they are sufficiently discussed day by day. But let me make a remark or two in connection with the principal product—viz., coke—which is among the topics that interest companies, corporations, and the public alike, seeing that it has taken two generations to impress the public with the advantage to be derived from using this excellent fuel—not so much due to the stupidity of the public as to the indifference of the companies. The take-it-or-leave-it principle was displayed to perfection for half a century. What was not taken voluntarily by an unappreciative public, was barged or carted away to regions unknown, at such prices as to frequently allow it to re-appear in the same district, and enter into competition with the company from whom it was originally purchased.

Many interesting circumstances have tended to end the indifference of companies and corporations to coke sales. (1) Competition in illuminants; hence more dependence on returns from products. (2) The lower maximum price allowed by Parliament in the large number of cases where companies have applied for further powers; and therefore a better intelligence is shown in its sale, in preparing it for domestic use by passing it through a machine for breaking it, and by keeping its value as a fuel well before consumers through continued advertisements. There is one other point, however, which must not be overlooked—viz., the virtue ascribed to it by the public, who are influenced by press notices, that if a smokeless fuel such as coke, or coke assisted by gas, or gas alone could be brought into general favour and use, the nauseating fogs now so prevalent in most of our big cities (especially London) would be a thing of the past. And this is so. It may not prevent fog, that is from the nature of things impossible; but it may to a certain extent prevent its dreadful and sickening blackness.

By a marvellous apparatus, showing much inventive and constructive genius, Mr. John Aitken, of Falkirk, has counted the dust particles in the air. Glasgow air on a wet morning showed 7,500,000 dust particles in a cubic inch of air; in Edinburgh, 4,000,000; in a room, 49,000,000; and in the air above a Bunsen flame, 489,000,000. Even in country districts, he counted 155,000 particles in the cubic inch; and the lowest count, at Lucerne, was from 3000 to 32,000—indeed, that there is dust in the upper regions of the air, is perfectly evident from the millions of meteors which fall into the atmosphere every day. Now, without dust particles in the air there would be no fogs. This, a simple but interesting experiment will prove. If two closed glass receivers are placed side by side, the one containing ordinary air, and the other, air filtered through cotton wool, a jet of steam being introduced successively into them, the following will be the effect: In the vessel containing ordinary air, the steam will rise, and a white foggy cloud will be formed, rendering the vessel thoroughly opaque. In the vessel containing filtered air, the steam remains invisible, without the slightest appearance of cloudiness. Invisible dust therefore is necessarily in the air to aid the formation of fogs—the reason of which is clear and apparent. There must be a free surface for condensation of vapour particles; and this is furnished by fine dust particles. Hence, the greater the number of dust particles, the greater the fog; for a dust particle forms the centre of every vapour particle. In our big cities, how are these dust particles formed? Is it due solely or principally to the combustion of raw coal? No. The brilliant flame, as well as the smoky flame, is a fog centre. If gas is burned in filtered air, there is an immediate production of intense fog when water vapour is introduced. The products of combustion from a clear fire and from a smoky one produce an equally foggy atmosphere. It is the sulphur emanating from coal combustion that is the active agent of fog in large towns. Burnt sulphur condenses in the air to very fine particles; and the quantity thus formed is very great. It is calculated that in London nearly 100,000 tons of sulphur are produced annually, and thrown into the air in

this way; or in one winter's day about 350 tons. Professo Roscoe remarks that no evil is without its compensation This enormous daily formation of sulphur is spread by natural means over the entire area of the great city, and serves to counteract the death-laden germs constantly being discharged from the refuse heaps and sewers, and so guard the entrances to the houses by its deodorizing and antiseptic properties. This is somewhat of a digression; but it is introduced as interesting to some who have not thought of the causes of the formation of fogs. It is also important that these facts should be kept well before the general public, in order that the due advantage of coke and gas as fuel may be better understood and appreciated by the community at large.

Consumption.

Press of other matter not a whit more interesting has interfered with my intention to deal at considerable length with the subject of consumption. The original articles on "Lighting," published in the JOURNAL OF GAS LIGHTING early in the year, calling attention to a subject much, if not altogether neglected, and which furnished good, useful, and reliable information treated from a scientific standpoint, were a real contribution to the literature of the Industry, reflecting credit alike on the author and publisher; and are in marked contrast to compositions bearing the clear impress of hurried writing, which mislead rather than guide. Among the most useful books published or in course of publication in connection with gas literature, is one entitled "Bibliography of Coal Gas"—being a subject-index to articles published in connection with coal gas to the end of the year 1891, edited by a well-known member of this Institute, who has done good service in bringing together in reference form that which would otherwise be lost to a very large majority of the profession.

The rapid improvement in gas-burners and in methods of heating and consuming gas for other purposes can be definitely traced back to the Exhibition held at the Crystal Palace in 1882. The regenerative system, then in its infancy, has now accomplished nearly, if not as much as can fairly be expected in that direction; while incandescent lighting will in the future occupy more of our attention. Indeed, much that does not appear on the surface is intimately dependent upon this further development; and although at the present moment there seems to be no incandescent burner in use that thoroughly satisfies what should be demanded of a burner of this class, yet there are indications that it may not be long in arriving.

Oil Gas.

The uppermost question of the hour, agitating the minds of thinkers in our profession, is the value of oil as a substitute for coal, either completely or in part; and the subject naturally ranges itself under these two heads of complete or of partial substitution. With regard to the first, the subject for a limited time was treated with a seriousness that in this country at no period up to the present has it really deserved. Complete information with regard to oil-gas manufacture is not at our disposal in England; but America furnishes us with sufficient instruction, if sought for with an open mind. With this end in view, early in the year, the best authorities on the question in that country were communicated with; and from information furnished me by Mr. Alex. C. Humphreys, of Philadelphia, together with Mr. E. C. Brown, the Editor of the *Progressive Age*, and the late Mr. George Shepard Page, an endeavour has been made to form some opinion on the subject, which may be of interest.

Under the first head of "Complete substitution"—that is to say, where gas was manufactured from oil instead of from coal—it was thought that a comparison of the total capital employed under the respective systems, the price charged, and the illuminating power obtained, would be some guide as to the estimation in which these rival manufactures were held by investors of capital, and through them, the opinion of the public who support them. The task undertaken, you may be assured, was an onerous one, the result of which will now be given as shortly as possible. The 289 works manufacturing oil or water gas employ in round figures $88,000,000 of capital, or about £17,600,000; the 538 works manufacturing gas from coal employ $173,000,000 of capital, or about £34,600,000. In 1891, the price at which oil gas was sold for lighting purposes averaged, for works with a capital of $250,000 and over (= £50,000), $1·60 per 1000 cubic feet (about 6s. 6d.); for works with $100,000 and under $250,000 of capital (£20,000 to £50,000), $1·91 (about 8s.); or an average throughout of $1·77 (about 7s. 3d.) per 1000 cubic feet—the prices ranging from $0·30 to $3·25; for works employing a corresponding capital, coal gas was sold at an average of $1·72 (about 7s.), ranging from $1 to $3·50 (4s. to 14s.); and $2·17 (or about 8s. 6d.), ranging from $1 to $5 (4s. to 20s.). The average illuminating power was as follows: Oil gas, 25 candles; coal gas, 19 candles. The minimum was: Oil gas, 18 candles; coal gas, 16 candles. Figures in a paper are tedious, and they have therefore been cut as short as possible; but the details will be found filed in the Library of the Institute for future use by any of our members.

It needs but little acumen to point the moral of these figures. It is true that capital outlay in America is considerably higher per thousand cubic feet of gas made than in England, but the range of price for oil and water gas, however manufactured, cannot possibly compete with coal gas, even in our northern cities, at anything like the price obtaining for coal in this country.

On Jan. 5 of this year, the late Mr. George Shepard Page wrote me as follows:—

> Coal gas is steadily gaining ground again, and cannot fail to occupy the principal place; water gas being used mainly as an enricher. Water gas cannot be made as cheaply as coal gas at any point in the United States 150 miles distant from the anthracite coal-fields and the oil regions.

This opinion is not, however, shared by the water-gas men of America; and it may therefore be well to quote from another letter received from Mr. A. C. Humphreys, who, in February and April of this year, wrote:

> The term "oil gas" is used to denote gas made by the ordinary distillation of oil in retorts, as distinguished from water gas made in cupolas and enriched by oil. It is estimated that during the past year (1891) there has been erected water-gas apparatus of a capacity of 24,700,000 feet per day, which means an increase of about 11 per cent. of the water-gas plants. This shows the activity in this special line of the gas business, accounted for by the fact that we have cheap oil, with which to co-operate; but it is also largely accounted for by the fact that the American public demands probably more than any other people on the globe, a high candle power light. This was very clearly demonstrated when the Pintsch light was first introduced in America. While its admirable mechanical details met with the approval of the railroad men of the United States, the lamps as first sent over by Pintsch were judged as being entirely insufficient; and those of the railroad men who had been travellers were opposed to the introduction of Pintsch, because they had formed their opinions from the poorly lighted cars which they had travelled in on the Continent. To make it a success on this side, therefore, it was necessary to expand in the direction of high candle power lamps; and nothing could be done with the railroad people until it was demonstrated that you could read perfectly in every seat of a long car. Electric light has been a very strong competitor of gas, and met with a very warm reception from the gas consumer of America, because it offered something new, and something more brilliant than he had been used to. It has been found, in the running of gas-works, that the only way the electric light could be competed with, was by supplying, say, not less than a 25-candle power water gas, or coal gas enriched with water gas. It has also been found that, where this course has been followed, care being taken to always treat the consumers as they had a right to be treated—supplying them with a uniformly even quality of 25 to 30 candle power gas—at the end of two years, we had nothing to fear from the electric light, especially the incandescent. Our larger cities are now almost entirely lighted with water gas. In New York, but little coal gas is made. I think I am correct in saying that it is only made at the old Manhattan station; all the other stations being water-gas stations. We have recently finished for the great Consolidated Company, at their Twenty-first Street station, one plant of 7,000,000 feet capacity per day; and they have there a like capacity from their old sets, under the Tessié du Motay patents—water gas. They have many other stations in the city equipped with water gas. Chicago is making all water gas. Baltimore, I think, is making all; if not, there is a comparatively insignificant amount of coal gas made. Boston is making both—I think about half and half; and so on through the list. Here, in Philadelphia, where the gas-works are run by the Municipal Authorities, coal gas was deeply rooted; but to-day, about one-third of their output is water gas, supplied under contract, into the city's holders, at a given price in the holders.

Reluctantly, I am compelled to bring to a close my remarks under this heading, and acknowledge my desire to pursue the subject further. My own distinct opinion, however, is that any system of using oil that does not properly crack it up in the presence of some good and suitable carrier of hydrocarbons, is wasteful, and to be avoided. On this point, I am tempted to again quote from Mr. Humphreys, in reply to certain queries I had put, where he says:—

> There has been a great deal of work done in connection with the use of oil in retorts, both in the making of an oil gas direct and in the making of it in connection with coal gas, and in the ordinary coal-gas retort. Considerable carburetting is done in this direction, and some of it is more or less successful. I always, however, regard this as a subterfuge. Of course, you can, if you are willing to put up with the annoyances, &c., enrich your coal in this way; but you must not expect to obtain the advantages that can be obtained through the

enrichment by oil of the water-gas process, because in the latter case you have a diluent which is an extremely good one for the carrying of hydrocarbons. In the case of oil introduced into the retorts, you simply put the oil gas into the gas to be enriched, without adding any diluent specially capable of carrying it.

In leaving this part of my subject, allow me to call attention to the unsatisfactory method pursued at most works where enrichment must take place, to raise the illuminating power to a certain point. This is generally done by mixing the gases in the retorts, either by injecting oil or admixture of cannel, sending the mixture as made on to the gasholders. This is a most extravagant mode of procedure; involving an unnecessary margin in the material used for enrichment, as well as the certainty that the better quality gas will leave the holder without mixing with the general contents. Enrichers, from whatever material made, should be suitable to the gas to be operated upon, should be manufactured and stored in a separate holder, and should be mixed intelligently with the gas to be enriched as it is being delivered to the district. In this way, any desired illuminating power may be maintained without an unnecessary margin for safety, and with absolute reliability. It will be found that great economy follows the use of this plan.

The Royal Commission on Labour.

The Royal Commission on Labour may certainly be regarded as a notable event, if only from the point of view of the opportunity it has given to observers to acquire a more complete knowledge than heretofore of the general state of the labour market in all trades, and amongst all sorts and conditions of men. Indeed, your Council has thought the event sufficiently important to request your President to comply with an invitation received to give evidence before the Commission, as coming from, and representing your Institute. The President consented; and involved himself and the Secretary right away in a mass of correspondence and work. The returns were so voluminous, so difficult to handle, and so complex to arrange, that he trusts he will receive the forgiveness of any who think more could have been accomplished.

As most of you are aware, eleven questions in all were addressed to the chairmen of the companies and corporations carbonizing about 5000 tons and upwards annually. These questions embraced, as far as the Council could determine, the essential points under review by the Commission. Circular-letters and lists of queries were addressed to 170 works, representing 4,380,090 tons of coal carbonized per annum. Replies were received from 110 works, representing 2,886,501 tons, or 65·9 per cent.; the 60 works not answering represented an estimated quantity of 1,493,589 tons, or 34·1 per cent. In the 110 works making the return, there were employed 5570 men in the yard, 1124 mechanics or artisans, 6067 stokers, and 749 firemen, or a total of 13,510; and in 60 works not replying, the *estimated* number employed was 2872 men in the yard, 596 mechanics or artisans, 3129 stokers, and 350 firemen, or a total of 6947; making the total number employed in the works 20,457. These numbers are without taking into account any of the London works.

The following is a short summary of the replies received. Questions 2 to 5 inclusive referred to the pay received by men employed in gas-works, each set of questions being divided into the following: Number employed (maximum and minimum); average wages per week; number of days per week; number of hours per week; rate of overtime; rate for Sunday labour; bonuses and gratuities, if any; percentage of increase in wages since 1887. Questions 6 to 11 inclusive had references to systems of conciliation, labour disputes, holidays, fines, Sunday rest; and the general remarks of the manager with regard to strikes, or other matter of interest connected with the Labour Commission.

Yardmen and Labourers.—In answer to Question 2, with regard to yardmen and labourers, the pay was found to vary from a minimum of 15s. to a maximum of 26s. per week. The number of hours employed varied from 49½ to 72. The payment for overtime varied from ordinary rate to time-and-a-half. Sunday labour was paid for at from the ordinary rate to double time. The percentage of increase in wages since 1887 was from 3 to 30 per cent. above the amount paid in that year.

Mechanics (*Question* 3).—The wages paid per week varied from 22s. to 39s. 9d. The number of hours employed ranged from 49½ to 84. The payment for overtime varied from the ordinary rate to time-and-a-half. Sunday labour was paid for at from the ordinary rate to double time. The percentage of increase in wages since 1887 was from 3 to 38·6 per cent. above the amount paid in that year.

Stokers (*Question* 4).—The wages paid per week varied from 22s. 6d. to 44s. The number of hours employed ranged from 48 to 90. Sunday labour was paid for at from the ordinary rate to double time. Increase in wages since 1887, from 3 to 50 per cent. above the amount then paid.

Firemen (*Question* 5).—The wages paid per week averaged from 25s. 8d. to 37s. 6d. The number of hours employed ranged from 48 to 90. Sunday labour was paid for at from the ordinary rate to time-and-a-half. Increase in wages since 1887, from 6 to 50 per cent. above the amount paid in that year.

It has been my endeavour to convey as briefly as possible, in a short synopsis, the information given in answer to these statistical questions (Nos. 2 to 5 inclusive). The impression conveyed, however, would be incorrect without some further remarks accompanying it. For this purpose, we will return for the moment to Question 2, with regard to yardmen and labourers, where it is true the rate of increase in wages since 1887 has been from 3 to 30 per cent. It should, however, be borne in mind that the bulk of works supplying the information asked, have only increased the wages either 5, 10, or 15 per cent.; only eleven works paying an increase of 20, 25, and 30 per cent.

Mechanics and Artisans (*Question* 3).—The principal increase in wages was from 5 to 15 per cent.; only 14 works paying an increase from 20 to 38·6 per cent.—six of these 14 paying from 15 to 20 per cent. more; and eight, from 20 to 38·6 per cent. more.

Stokers (*Question* 4).—The increase in wages is stated to range from 5 to 50 per cent. The bulk of the works making the return are under 20 per cent. increase; eleven works, from 20 to 30 per cent; nine works, from 30 to 35 per cent.; two works, from 35 to 40 per cent.; nine works, from 40 to 50 per cent.

Firemen (*Question* 3).—The increase in wages since 1887 is stated to be from 6 to 50 per cent. In most cases, the increase is under 20 per cent. But in five works it is from 20 to 30 per cent.; in one, from 35 to 40 per cent.; and in one, from 45 to 50 per cent.

To return again to the yardmen and labourers, the wages are given at from 15s. to 26s. per week. This works out at an average of 21s. 9d. Mechanics' and artisans' wages vary from 22s. to 39s. 9d. per week; or an average of 30s. 5d. Stokers' wages average from 22s. 6d. to 44s.; or an average of 31s. 1d. There are only five works, however, where the wages range from 40s. to 44s. per week; and in every case, it is for seven days' work. Firemen's wages average from 25s. 1d. to 37s. 6d. per week; or an average of 32s. 5d. We may therefore recapitulate the information as far as wages are concerned, as follows:—

	Per Week.
Average amount paid to yardmen and labourers . .	£1 1 9
" " " mechanics and artisans . .	1 10 5
" " " stokers	1 11 1
" " " firemen.	1 12 5

In reviewing generally the answers given to these statistical questions—answers full of information and instruction—the conclusion forces itself upon us that there is no indication of general over-pay in any of the works' departments; and one is, therefore, compelled to agree that any increase that has taken place was to be expected, as the legitimate outcome of surrounding influences other than those caused by the dictation of Trades Unionists. Our manufacture being a continuous one, wages should be liberal; and we cannot conscientiously admit that they are at present too high. Whether a man provides for the future or no, he should have the opportunity. He ought not to be in such a position as to advance the plea of inability; then if he neglects his duty in this respect, he will gather no sympathy—which is a great point with us all. If we would be served by good and intelligent labour, we must offer it something better than the workhouse or the benevolent fund, after years of faithful service.

I now pass to questions the answers to which may perhaps be more interesting, as they are those recording individual opinions, and may not be such dry reading. Most people's original opinions are more entertaining than their figures.

Question 6, was worded: "Does any system exist in your district providing for conciliation, arbitration, sliding scales,

or other means of preventing or arranging labour disputes?" Only 25 replies were received to this query, from the 110 returns made; and all but one said that they knew of none in connection with gas-works. Many were, however, aware of Conciliation Boards in connection with the iron trade. One gentleman replied "Labour is king," presumably meaning to imply that "Kings do not require Boards of Conciliation."

Question 7 was: "Can you suggest any means of avoiding or arranging labour disputes, and promoting cordial relations between employers and employed in gas-works?" To this question there were 53 replies; and the answers covered five pages of closely-written foolscap. Summary is difficult. The suggestions made were as wide as the poles—ranging from a coercive Act of Parliament to open treaty with the Trades Union. There were sensible suggestions of payment by results, bonus systems, the formation of a superannuation fund, profit sharing, and Boards of Conciliation. It was indeed gratifying to find that the large majority had no desire for any power beyond that of kindness, firmness, and justice; and a large number had never had, nor did they anticipate, any disturbance—their relations with their employees being good.

Question 8 was: "Have you any system of holiday or other privileges to workmen, deferred pay, sick payment, pension, pecuniary assistance in case of accident, or other insurance fund?" Here 101 replies were given out of a possible 110; and although they occupied the space of the last, were not so difficult to summarize, seeing that every works gave to their men holidays of some kind, ranging from 3 to 10 days, with payment during absence. Most gave certain gratuities, payments in case of accident or prolonged illness, double pay for Christmas Day and Good Friday, annual excursions, and other privileges not expected from employers in other trades.

Question 9 was: "Do you make deductions by fines or other forms of stoppage?" Answers to this were received from 104; and were all practically a negative.

Question 10 was: "Have you any system of Sunday rest for men employed seven days to the week?" All but one—viz., 109 out of 110—answered this query. I was glad of this, as, from my point of view, it was one of the most important. Three works ceased work from 6 a.m. to 6 p.m., and two from 6 a.m. to 10 p.m.; but all the others, except in one instance (that of my own), had no system of seventh-day rest. Many said they rested when they could; some, that they did no more work than they could help; in 37 cases no attempt was made to deal with the question. There were three on the eight-hour system, which allowed each man 16 hours out of the 24; and in one case only was the return worded: "All employees work six days only, though the rest day for the stokers and firemen does not necessarily fall on Sunday."

Question 11 was: "General remarks on strikes or any subject of interest connected with the Labour Commission." Advice under this head was considerably varied, although only 24 attempts were made to answer. Several advocated compulsion by law, and more stringent application of punishment in cases of picketing or intimidation; some, mutual forbearance, kindness, firmness, argument, and moral suasion, believing that men were amenable to reason, and that motives of self-interest had a sufficiently restraining force. Many had found it so. Others advised agreements for long terms, combination amongst employers, and others a Board of Conciliation, the members to be furnished by this Institute.

In reviewing the answers to Questions Nos. 6 to 11 inclusive, which give individual opinions formed by experience as well as from observation of surrounding circumstances, they must be regarded by us as a very valuable contribution to the general knowledge of the subjects to which they refer, and may be seen in detail by any of the members of the Institute, a copy having been placed in the Library for that purpose.

This impression is left on my mind by a study of the question as a whole, for although given in great detail, they lead up to one general consideration—viz., "Is everything done that might be done to give more general satisfaction to our workmen; or is something done that would be better left undone?" Most of the suggestions were made as a remedy for an existing disease—the disease of discontent, which we all heartily deplore and would gladly remove. All will agree that prevention is better than cure. This will lead us to examine the ground carefully, to ascertain if there exists anything that might be removed, or if some means can be discovered by which the recurrence of periodical discontent may be prevented.

Again, running through the evidence given, we find the rate of pay fairly good; the intentions of the managers excellent; their desire for a good understanding undeniable. Bonuses, extra pay, holidays, and various other privileges are all accorded with but one object in view—viz., the desire to create contentment. But we fail, and fail most miserably, and why? Why this constant cropping out of discontent? In my opinion, the cause is not far to seek; it is close by, contained in every answer to Question 10—"Have you any system of Sunday rest for men employed seven days to the week?" Only one works out of the number making a return could answer "Yes, we have;" every other works had to confess to only partial attempts, the greatest being one or two who ceased work from 6 a.m. to 10 p.m. This is not a seventh-day rest. To do what is done necessitates the presence of caretakers on the premises, men responsible for the fires and pressures; and a great amount of anxiety and heavy work remains for those who have to start a dead works in the dark on a Sunday night. If anything has been gathered from the returns made, it is the strong evidence that it is in this we are behind other manufactures of an even more arduous character, where the pay is not so good, and the privileges are *nil*. We must set ourselves to face this seventh day's rest question, or we shall never be able to enjoy peace by giving satisfaction to our workmen employed seven days to the week. Evidently it is here we are wrong; and when we try to understand what seven days' labour means, are we surprised? It is more to be wondered at how human endurance can go as far as it does; but at what sacrifice is it done? Seven days' work not only lowers the physique, it undermines the health, and weakens the mind of every man who attempts it. Should we wonder then if we are met by unreasonable demands from men, who are not ungrateful but whose minds and bodies have been degenerated by ourselves and prepared for the hands of the professional agitator? My own opinion is that gas manufacture is a seven days' arrangement, and works cannot be stopped without loss and damage; but, Gentlemen, a seventh day's rest, although it need not—indeed, cannot—always fall on Sunday, is essential to us all, and cannot be disregarded without serious consequences to all. Let me then urge you to set about arranging for a seventh day's rest to each of your men now working seven days to the week. It is not a difficult matter to overcome, nor is it an expensive one. But even were it both, it should nevertheless be granted, from motives of justice to yourselves, to your employers, and to your workmen.

To my mind the question of old-age pensions can be more easily undertaken by gas companies than by most other manufacturing bodies. If gas companies and corporations would combine and form a central association or fund, into which all employers and employed contributed a fair and equal amount, based as a percentage of the amount received by the employed, surely there would be no great difficulty in providing pensions for old age for gas-works employees. At the present time one of the weak parts of the bonus or other systems is that they are confined to individual works, generally large ones. But if the principle were universally accepted or made compulsory in gas-works, large and small, then the removal of a man from one works to another would not interfere with the amount of claim he would eventually have upon the general fund, which should from time to time receive a fixed percentage of the wages earned by the workman or officer as the case might be, together with an equal amount paid by the gas company or corporation. This would then entitle a workman or officer, on attaining a certain age, to receive a pension for the rest of his life, calculated according to the gross amount of pay received; and although a person on reaching a certain age might be legally entitled to this pension, it need by no means follow that he *must* retire on reaching this specified age.

Increased wages paid under the head of profit-sharing would, I think, only act as a temporary stay of agitation; and eventually the cure would rival the disease. If the principle of profit-sharing be admitted, the more serious contention arises, How much of that profit is the equitable share of the workman? To-day he may accept 5 per cent.; but human nature will prompt him within a limited time to

ask for more, and it will be difficult to draw the line as to where that share should end. I rely far more on a fixed rate of wages, maintained as high as can equitably be done, with some arrangement for compulsory saving. When it is remembered that for a payment of 5d. per week, commencing at, say, the age of 21, a sum of £10 per annum can be secured when the age of 65 is reached, or that 1s. per week, paid between employer and employed, will secure at that age a pension of £25 a year, it is worth attempting —always bearing in mind that, should the intended pensioner not reach that age before death, a sum equal to the capital amount paid, with 2½ per cent. per annum added, would be at the disposal of his family. Bonus paid in the shape of profit-sharing is a variable amount, as has been already experienced; and the question suggests itself, if the workman is to share the profit is he also to share the loss? If not, it is a one-sided arrangement—imperfect in principle; the fact being that no remuneration for service rendered can give satisfaction unless it is *wholly* dependent on a division of profits and at the same time embraces loss; or by an arbitrary payment of a wage such as at present exists.

Before taking final leave of the subject, allow me to say a word or two on a kindred topic which more or less directly affects every member of this Institute—viz., the plan followed by companies and corporations when about to engage educated men as officers of their undertakings. It is no uncommon occurrence to find advertisements in the public press in reference to positions in and about a gas-works, from the engineer downwards, which there can be no hesitation in stigmatizing as objectionable and degrading to the self-respect of applicants who should, if suitable for the appointment, be gentlemen. To have reasonable expectation that young men will properly prepare for the profession, and that men in the profession will continue actively to give interest and attention to the important matters that are within their domain, a fair stimulant must be provided by companies and corporations, by offering sufficient remuneration for the services which the members of our profession are called upon to render. It is notorious, however, that whilst companies and corporations fail to provide the one, they rigorously demand the other. How often has the warm blood rushed to the head to see a bare-faced advertisement for an engineer or manager, or both, demanding of applicants full qualifications for these important posts, with an altogether insufficient, or indeed decent sum named as remuneration; and more often than not the candidate is himself to mention the sum at which he is willing to undertake the duties of the appointment. To my mind this is nothing better than putting up to Dutch auction the best interests of consumers and shareholders. This mode of proceeding is now common enough to demand some notice, in order that the attention of directors and committees may be directed to such a suicidal policy, and to point out what will be the inevitable consequence.

Thirty years ago, the want of educated men was keenly felt in the profession. Some clever men outside it saw this and encouraged their sons to study and prepare. The result has been a very marked improvement in all the executive departments of a gas-works. Sufficient margin is left for still further improvement; but how is this to be accomplished if companies assume that there are so many good men already in hand as to make it safe to allow them to compete among themselves on the question of remuneration? Many men now in the profession may from circumstances be compelled to serve their employers at an inadequate salary because they cannot help themselves. They being already in, must remain; but will they educate their sons to follow? No! Indeed, they cannot. To educate their sons as professional men is outside their means—it is more than they can accomplish. What then will be the consequence? Good men will once more be as scarce as they were thirty years ago; and in the place of earnest, striving, hard-working enthusiasts, endeavouring by intelligence and industry to keep pace with the march of Science, and conserve the interests of the great gas industry, we shall see those, who from want of intelligence or interest, or both, will be powerless to prevent other competing industries passing them in the race for existence. The right understanding of this subject is of such vital importance to companies and corporations, that a word or two in season may have the desired effect. Every position, from the engineer to the office-boy, has what should be its standing market value at the moment of the engagement. Let that value be paid. Do not set up competition amongst the anxious seekers for employment at a time when it is impossible for them to put a proper value on what you wish to purchase from them. Give the man you put in a certain position, whoever he may be, the means of doing what you demand of him—viz., that of occupying the position with self-respect and credit to you. When a position is vacant, let the salary attached to it be known and fixed high—let the remuneration be what it should be; no money can be better spent. There are prizes in our profession as in all other professions. Let those prizes be worth obtaining. Increase their value, and you will raise the standard. Companies and corporations may then rely on securing men of education and judgment, who will do justice to their works and credit to themselves.

It is not too much to say that most writers and speakers on this all-engrossing subject of "capital and labour" end their discourse with the consideration of one or both of these allied subjects; yet there is another consideration more important than either—knowledge. It is known to all how largely the success of an undertaking of any nature rests on the individual. This may be less so in the case of companies, who are the inheritors of what has gone before and who are only called upon to continue existing practices. But without capacity, judgment, and training, how are the new problems arising from time to time for consideration to be properly disposed of by the "Individual" on whom after all rests success or failure? It is acknowledged by all to be impossible for a body of shareholders or ratepayers to act for themselves, and perforce they must elect directors or a committee to act for them. But the usual board or committee can only carry on that which they have inherited, suffering in proportion as they are without good expert advice. They cannot devise new methods, nor suggest fresh developments; their duty properly ceases with the "Organization." It is impossible to stand still—to attempt it is to retrogress; and without the patient intelligent labour of the individual, no possible work can go forward. Yet companies, corporations, and municipal authorities act as if this fact were unascertained or uncertain, and are too often willing to sacrifice many thousands of pounds, paid uselessly, rather than as many hundreds in fair remuneration that may command servants possessing the necessary qualifications.

Conclusion. I would in conclusion, say that, conscious of the deep responsibility that devolves upon the President of this Institute for the time being, it has been my earnest desire to approach the subject-matter of the annual address with a due sense of the importance attached to it by its members. At all times during its preparation, the impression was prevalent in my mind to deal impartially and faithfully with the various topics referred to; and although these may have been imperfectly or superficially disposed of, I am satisfied if I have succeeded in making a few remarks that may be regarded by some as useful; or if I have in any way impressed our younger members with a due sense of their responsibility to themselves, to their employers, or to this Institute; or if any words of mine should be the means by which may be made known the earnest character of the bulk of the men who constitute the members of this Institute, who by their patience and perseverance acquire sound scientific knowledge which they communicate to each other, when they meet from time to time, and who are bent upon showing their determination that this Institute shall worthily continue to hold its legitimate place as the body representative of the great gas industry.

Annual Report of the Council.

The following are the principal matters referred to in the annual report of the Council, which forms the subject of the second paragraph in the foregoing address:—

The Council commence by stating that, closely following the successful meeting held at Carlisle last year, an invitation was received from Committee C of the Royal Commission on Labour, under the chairmanship of the Right Hon. A. J. Mundella, M.P., to submit the name of a witness on behalf of the Institute to give evidence before the Committee. In response to this invitation, and to meet the unanimous wishes of the Council, the President (Mr. W. A. Valon) consented to undertake this responsibility. As will have been seen by the address, a great many

details connected with the subject were obtained; and the Council express to those gas authorities who, at their request, supplied statistical and other information, their very cordial thanks for the kindly interest they took in the matter. They also thank the President for the unsparing manner in which he devoted his time and labour in order to carry out efficiently, and to the credit of the Institute, the duties he thus voluntarily undertook. They remark that only those who have had experience in the tabulation and comparison of returns can adequately realize the nature and extent of the labour involved. Provided the necessary official sanction can be obtained, the Council propose to publish in the Transactions the evidence given in connection with the gas industry. In order to continue the procedure found so effective heretofore in dealing with the various matters which, from time to time, come under the consideration of the Council, the three Committees mentioned in last year's report—viz., the Publications Committee, the Technical Committee, and the General Purposes Committee—were re-appointed early in the present session. Allusion is next made to the reference last year to the action of the Inland Revenue Department in seeking to bring sulphate of ammonia works under a clause in the Act 9 & 10 Vict., cap. 90, which makes it compulsory that a "still" licence should be taken out at a cost of 10s. During the past session, the question was again brought under the notice of the Council by an application from the Association of Sulphate of Ammonia Manufacturers for the co-operation of the Institute in aiding the Association to bring the matter to a decision. Acting upon the favourable recommendation of the General Purposes Committee, to whom this communication was referred, the Council agreed that, to a limited extent, the Institute should share with the Association the expense of obtaining Counsel's opinion upon the question. Passing on to deal with the progress of the Institute, the Council state that the position at the close of last year, as regards members, was as follows: Honorary, 21; ordinary, 427; extraordinary, 45; associate members, 30; and associates, 57—making a total of 580. Last year 26 candidates were elected as members, eight as associate members, and one as an associate; two additions were made to the list of honorary members, and four transferences took place to the class of members. While regarding these figures with satisfaction, the Council call special attention to the fact that the capabilities of the Institute, and the advantages it can offer, are largely dependent upon the number of its members; and they point out that it is important not merely to keep up, but also to increase, the numerical strength. Reference is next made to the loss the Institute has sustained by death. The members who have passed away are: Samuel Barratt (Manchester), William H. Bennett (London), Charles E. Broadberry (Waltham Abbey), Joseph C. Colver (Sheffield), Josiah Deakes (Worcester), Neill Meiklejohn (Longwood), George Shepard Page (New York), and John Stores Smith (Sheepbridge). Feeling reference is made to Mr. Bennett's work as Secretary of the Institute from 1869 until 1888; and the Council consider that, in placing upon record a few words expressive of respect for his memory, they are acting not only in accordance with their own sentiments, but also with those of the members generally. A list of donations to the library is appended to the report; and the Council tender, on behalf of the Institute, their thanks to the respective donors. With respect to the financial position of the Institute, attention is called to the fact that on Dec. 31 last, to which date the accounts are made up, the legal expenses in connection with the incorporation of the Institute and those attending the publication of the Transactions were still outstanding. The Council are, of course, anxious to clear off these liabilities as quickly as possible; and they think that, to a great extent, this could be accomplished out of the ordinary income, without having recourse to the realization of invested funds, if the subscriptions in arrear were promptly remitted. Having in their recollection the financial support formerly accorded to the Institute by various gas companies and corporations, the Council issued towards the end of last year a circular to the various works represented in the register of membership, soliciting the continuance of this support. The appeal, although made late in the year, brought a number of responses before its close; and further contributions have been received during the present year. The Council place on record their thanks to the subscribers, and assure them that they will endeavour that the work of the Institute shall be productive of good to the gas industry; and thus merit the support received. The final paragraph of the report states that, in accordance with the regulations connected with the Birmingham Medal, the Council have decided to make the award of the medal this year.

An appendix to the report contains the recommendations from the three Committees referred to therein. The Publications Committee, of which Mr. J. Hepworth is Chairman, suggest for the consideration of the Council the desirability of giving, in an early issue of the Transactions, a general index to the papers and communications which have appeared from the commencement. Expenditure in this direction would, in the opinion of the Committee, be amply repaid by the advantage of having at hand so useful a reference to past proceedings. The Technical Committee, which is also under the chairmanship of Mr. Hepworth, having in view the importance of the gas industry to the public in connection with the supply of light, heat, and power, suggest to the Council the propriety of endeavouring to obtain a subsidy from the grant which is annually made by Government to scientific institutions for the purposes of research. The Committee are aware of the limited funds at the disposal of the Institute; and therefore recommend that, with a view to extending its general utility, an application should be made in the proper quarter for assistance in prosecuting scientific research in matters connected with the gas industry. The Committee have under consideration several important subjects, and the results of their investigations thereon will be presented in due course. The General Purposes Committee is under the chairmanship of the President (Mr. W. A. Valon). The Committee report that they have had under consideration a letter from the Association of Sulphate of Ammonia Manufacturers, asking the assistance of the Institute in bringing forward a test case, in order to settle the legality of the action of the Inland Revenue Department in regarding sulphate of ammonia works as being subject to the operation of the Inland Revenue Act. Having taken into consideration the fact that many members of the Institute are manufacturers of sulphate of ammonia, and that the final settlement of this question would be a matter of considerable interest to them and their undertakings, the Committee recommend, as already intimated in the Council's report epitomized above, that the application of the Association should have favourable consideration.

The Berthelot-Mahler Calorimeter.—An interesting feature of the meeting of The Gas Institute this week will be the exhibition, by Mr. B. H. Thwaite, Assoc.M.Inst.C.E., of Liverpool, of the Berthelot-Mahler Calorimeter, which he described in the course of a paper read at the recent meeting of the Iron and Steel Institute in London. He will also, if permitted, give a few notes on the calorimetric value of gas, determined by M. Pierre Mahler in conjunction with M. Sainte-Claire Deville, son of the distinguished French chemist and engineer.

Presentation to Mr. J. Chadwick.—The members of the Oldham Gas Students' Association have recently presented their President, Mr. John Chadwick, the Engineer of the Oldham Corporation Gas-Works, with a handsome carbon portrait of himself, on porcelain. The presentation was made on the occasion of a picnic to Marple and Romilly. Mr. Arthur Andrew, on behalf of the members, asked Mr. Chadwick to accept their gift; and, in doing so, he traced the history of the Association during the 25 years of its existence. Their President was one of the founders; and he had been at their head for a number of years. Mr. Chadwick, in acknowledging the present, confessed that he had been taken completely by surprise; and he thanked the members most sincerely for their kindness.

A Water Supply Map of London.—We have received from Mr. E. Stanford, of Cockspur Street, Charing Cross, a copy of the Water Supply Map of the County of London, which he has lately published. It forms one of the "Government of London" series; and it shows the boundary of the jurisdiction of the London County Council, and the areas supplied within the county by the eight Water Companies. The district served by each Company is coloured a light tint; the portions under constant supply being tinted a darker shade. This is a good plan, because it allows the extensions of the constant service to be recorded from time to time as they are made. Where two Companies supply the same district (as in the case of the Southwark and Vauxhall and Lambeth Companies), the area is tinted in bars of the colours assigned to each Company. The map bears in one corner some useful statistics relating to the Companies, and concise information as to their sources of supply and storeage capacity. At the present time, when so much attention is being given to the Metropolitan Water Question, the map will be found to be specially valuable to all officials.

The Portland Cement Trade of the World.—According to a paper recently read by Mr. Giron before the Engineers' Club at Philadelphia, dealing with the Portland cement trade of the world, the annual production of this article in Europe amounts to upwards of 20 million barrels, the commercial value of which is about £7,200,000. Cement manufacture was first introduced into Germany in 1852. Now there are in the Empire 60 large works, the annual production of which is the same as that of the English works. In France the industry grew slowly. The total production in 1880 hardly exceeded 750,000 barrels a year; now it is 1,800,000 barrels. The works of the Company of French Cements at Boulogne form the largest Portland cement factory in the world, turning out about 800,000 barrels a year. In Russia the first works were established in 1857; and there are now eight factories, producing annually 900,000 barrels. In Belgium there are four works, turning out 800,000 barrels. In Italy the industry does not really exist, although a certain kind of natural Portland cement is made. In Denmark and Norway and Sweden there are ten factories, making about 800,000 barrels yearly. Portland cement was taken into the United States as early as 1868. In 1882 the amount imported was 370,406 barrels, last year it exceeded 3,000,000 barrels. Little effort has been made to develop the manufacture across the Atlantic; the cost of the system being very much too great to make it successful.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1136.)

Last week was an extremely quiet one in the Stock Markets. The weather was too fine for the Whitsuntide holiday makers to hurry back to town; and consequently the attendance was decidedly light at first, while later on the approaching settlement engrossed most attention. The event of the week was the stoppage of the New Oriental Bank; but that created very little disturbance, and none at all beyond its own legitimate sphere of influence. There was some disposition to sell at first. But it did not last long; and a full recovery was effected before the end of the week. Money continues in the same state of plethora—seeking employment, and finding none. Never was there a greater supply of any commodity when it was least wanted. The Gas Market has been exceedingly quiet; transactions throughout the week being so extremely restricted as to be scarcely worth mentioning. Changes in quotation also have been few and slight. The tendency on the whole has been rather downward, although the chief issue—Gaslight "A"—has moved 1 the other way. The best prices of the week, however, were in the early part of it, from which point they gradually drooped away—marking 208 at the close, against 212 on Wednesday. Hardly anything was done in the debenture and preference stocks; but several transactions were effected in the "H" 7 per cent. limited at good prices. In South Metropolitans, the "A" has been put down 5 more; but no business was marked in it. A few dealings were done in the "B" at figures rather below the average. Commercials were little touched; but the new stock was offered on easier terms; the quotation falling 2½. The Suburban and Provincial Companies were without any feature whatever. Business was just as quiet in the Foreign department as in the Home. Among the Continentals, Imperial continued to recede to a slight extent; the quotation showing a loss of 1. The rest presented no point calling for notice, except Chicago First Mortgage Bonds, which rose 2½. The Water Companies, on the whole, were very firm, though East London fell 2; and pretty well all transactions marked were at good prices.

The daily operations were: Gas was very quiet on Tuesday, the opening day; but the tendency was favourable, Gaslight "A" advancing 1. East London Water fell 2. Wednesday was just as quiet. Gaslights were firm; but South Metropolitan "A" fell 2. Chicago First Mortgage Bonds rose 2½. Thursday brought no increase of activity; and everything remained quite stagnant. There was not much more done on Friday; but quotations moved down—South Metropolitan "A" receding 3; and Imperial Continental, 1. In Water, Lambeth rose 1⅛; and ditto, 7⅛ per cents, 1. Saturday was like the rest of the week; for it could not easily be quieter. The only change was a fall of 1 in Commercial new.

ELECTRIC LIGHTING MEMORANDA.

Another Illusion Gone—No Profit on Electric Lighting in America—The Blackpool Corporation Electric Lighting.

It is to be feared that by the inconsiderate publicity given to the messy cooking by electricity at the Crystal Palace, a deadly blow has been struck at one of the most cherished privileges of the modern mystical story-tellers of whom Marie Corelli may be taken as the best representative. These writers, some of whom, like the clever authoress named, appear to take themselves quite seriously, have been very fond of dragging in electricity to explain all sorts of things for which no intelligible *rationale* could be given. Like the old lady with that "blessed word Mesopotamia," our imaginative novelists thought they had safely laid up in the mysterious form of energy known as Electricity a measureless store of occult power which could always be drawn upon to good sensational effect But this must now be given up. It was all very grand and noble to write about "electric circles" while electricity was hardly known even by name to the novel-reading multitude. But to a Philistine who has seen shaving-water boiled by electricity, omelettes fried, and curling-irons heated by it, there is little romance left in the word. It is a mournful disillusionment; but we fear it is impossible any longer to conceal the crude truth that there is nothing essentially more awe-inspiring in electricity than there is in the weight, the bulk, or the chemical affinities of that unromantic matter, the very name of which is so repellent to the fine spirits of the mystics. May it not be said, moreover, that there is a spice—just a suspicion—of vulgarity about these recondite people, in respect of their ignorant haste to pay homage to electricity, merely because it is the latest attribute of matter which the laboriously inquiring human mind has been able to envisage? What our modern mystics have done in respect of electricity, is only the same as their forefathers did when chemistry was the very latest thing out, and *their* ancestors in the yet earlier time when mechanism was coming to the front in a world of animal power. How little of originality there is in the human (literary) imagination! *Omne ignotum pro magnifico* is still the universal rule; and with none more than with those who profess to be most "emancipated." The truth is that there is nothing in the universe more wonderful than another thing—no aspect or effect of Nature more mysterious or awful than another; but all things and processes are part of the Cosmos which we know of as existing, because we ourselves exist, but which we shall never comprehend.

The National Electric Light Association of America is an organization of the same class as the many Gas Managers' Associations of the Continent—that is to say, its membership is chiefly made up of men who are practically engaged in the industry from which its title is derived. The associated electricians meet and read papers and discuss them once a year; but anyone who may have had an impression that there must be something very scientific and abstruse about even commercial electric lighting would be cruelly undeceived by perusal of the printed records of one such meeting. Like all other traders, the Yankee electricians think more of dollars than of physical science problems; and their papers and debates are consequently of little interest or value to anybody, even if engaged in the same business, who has to deal with a different set of circumstances. Yet it is worth while to bestow an occasional glance over the transactions of the associated American electricians, for the purpose of correcting the roseate view of the condition of electrical industries in the United States to which we are occasionally treated by our advertising electrical specialists. At the last meeting of the Association, which was held in Buffalo, a Mr. Ernest Wiman read a paper which was a singular mixture of "high-falutin" and frank admission of facts. It is unnecessary to repeat any of the former; but some of Mr. Wiman's rational statements are worthy of notice. He confessed that while electric lighting is in the United States "an article of merchandise of real value, for which there is a strong demand," the "question of profit remains to be decided in very many localities." He had instituted a general inquiry into the condition of electric lighting business all over the States, and had come to the conclusion that, in order to make it go down with the public, the price of incandescent electric lighting was generally too low to pay the suppliers. "The public estimation of the cost of electric lighting has been allowed to prevail to an extent destructive of profit." Mr. Wiman goes on to admit that, "taken as a whole, the result in the shape of a total profit on the total investment in electric lighting is not to be seen in the shape of dividends." What a commentary is this upon the parrot-talk of our English electricians about the wonderful popularity of electric lighting in the States, and the injury inflicted upon the British industry by the Electric Lighting Acts! Mr. Wiman quotes one gentleman—the president and manager of five electric light companies, some of which are bankrupt, and not one being in a really satisfactory position—as saying: "I am aware that books can be kept so as to show an earning; but this is, in many cases, at the expense of a constantly depreciating capital investment." We seem to hear an echo of this remark from more than one locality nearer home.

In another column we give some particulars, taken from the report of the Superintendent, Mr. William Chew, upon the working of the Blackpool Corporation Electric Light Department. This is an exceptional venture—only arc lighting being at present supplied, and this even being confined to the Marine Parade, where it forms an attraction to promenaders during the summer months. We cannot gather from the report the exact number or consumption in ampères of the lamps now in use for this purpose; nor do we understand when, or under what conditions, the Blackpool Corporation contemplate supplying incandescent lighting, with the exception that they will not be empowered to charge more than 8d. per unit, at which price it will be four times the cost of gas to the local consumer. Taking all working charges into the account, but not including anything for depreciation or interest on capital, Mr. Chew finds that their electricity cost the Blackpool Corporation after the rate of 8·70d. per unit last year, or 6·48d. per unit without the maintenance and renewal of the masts. If this is the cost of electricity to the Corporation of Blackpool, working under unusually favourable conditions, with the son of their own Gas Manager taking the supervision of the plant, and doing his best to keep expenses as low as possible, one can but form the opinion that there must be an unpleasant "secret" in store for those local authorities who fondly imagine that they can sell current at a profit for 6d. per unit.

The Transactions of the Sanitary Institute.—We have received from the Secretary of the Sanitary Institute (Mr. E. White Wallis, F.S.S.) the volume of Transactions of the Institute for the past year. It is somewhat smaller than usual, owing to the usual autumn meeting not being held, in consequence of the holding of the International Congress of Hygiene and Demography. It, however, contains, in addition to the annual report and statement of accounts, three papers read at sessional meetings; one being on the "Sewerage of the Town of Maldon (Essex)," by Mr. R. F. Grantham, M.Inst.C.E., which has been already noticed in the Journal. There is also a lecture by Sir Douglas Galton, on "Ventilation and Measurement of Cubic Space." In addition to the usual lists of members, &c., there is given in an appendix a catalogue of the Parkes Museum, the plan and general arrangements of which are shown on a plate.

FRENCH RULES FOR LIGHTING.

(*Continued from p.* 1056.)

After discussing the subject of the mean lighting of a surface, as noted last week, Dr. Palaz takes up that of the distribution of lighting from sources which, like the electric arc, do not radiate equally in all directions. Electricians always endeavour to make a great point of the peculiarity of arc lights, in radiating their strongest light not immediately underneath the lamp column, but at an angle of about 40° with the horizontal. M. Wybauw has prepared some clever diagrams to illustrate the effect of different kinds of light-sources, which are noticed by Dr. Palaz; but we are soon led to consider the method of studying the problem of lighting proposed by M. Loppé, of which the author appears to think highly. M. Loppé proceeds upon the assumption that the luminous intensity of his light-sources is equal in all directions; and he poses the problem of lighting a surface from sources placed at the summits of equal squares. So far as we are aware, this treatment of the subject has never before appeared in English. It proceeds as follows: Let us suppose four sources of equal uniform intensity, of equal height, placed above a horizontal plane, at the summits of a square, what is the point of the plane situated in the interior of the square which has the lowest lighting intensity? It is found that the point of meeting of the diagonals of the square receives the least light when $h > a\sqrt{3}$, where a = half the distance of the lamps apart, and h = their height.

The next problem to be dealt with is the *lighting of a horizontal plane by means of sources of uniform intensity, so that the intensity of lighting at any point whatever shall be at least equal to a given quantity, using for the same the smallest possible expenditure of energy.* There are two cases of this problem: (1) A plane area to be lighted. In this case, the lamps are to be put in projection on the summits of squares; (2) a street to be lighted. In this case, the lamps are usually placed in quincunx, from one side of the street to the other. In the first, the greatest amount of light which falls on any point of the interior of one of the squares evidently comes from the four sources projected on its summits. If $2a$ is the side of one of these squares, it follows that, whilst the condition $h < 1{\cdot}732a$ is realized (which is generally so in practice), the point of least lighting is the meeting of the diagonals. The spacing of the sources can be calculated so as to produce at this point the minimum effect required, neglecting the additional lighting coming from the more distant sources. If h = the height of the lamps above the plane, $2a$ = the spacing, or the side of the squares, I = the luminous intensity of the sources, the intensity e of the lighting at the intersection of the diagonals is given by the formula $e = \frac{4Ih}{(h^2 + 2a^2)}$. This formula enables us to solve the following problem: *The height of the lamps above the floor being given, to determine the luminous intensity I, so that the expenditure of power shall be the minimum.* The number N of the sources required to light a surface S being $N = \frac{S}{4a^2}$, the next step is to solve the equation $I = \frac{(3)\frac{3}{4}h^3 e}{4h} = 1{\cdot}30\,e\,h^2$

Photometrical calculations relating to the lighting of open spaces deal with a number of particular problems. The height of the lamps is an important element in any system of lighting. The spacing of the lamps being equal to $2a$, the lighting at a distance a from the source is a maximum when the height of the lamp-post is given by the formula $h = \frac{a}{\sqrt{2}} = 0{\cdot}707a$. This height is seldom adopted in reality, chiefly because the expense would be too great with lamps of any reasonable height. Dr. Palaz says that no street-lamps placed along the curb should exceed 100 candles illuminating power. If, however, for streets (especially when narrow), sources of low intensity are preferable to powerful lamps, this does not follow for large open spaces, for which high-power lamps on lofty posts are indicated as most effective and economical. Thus, he states that posts for 10 ampère arc lamps should be 10 metres high; for 13 ampère lamps, 15 metres high; and for 15 ampère lamps, 18 metres high, disposed in quincunx according to the minimum effect that is desired.

From the point of view of the uniformity of lighting over a large area, it is evidently advantageous to employ a large number of small lamps; but when powerful lamps are employed, the effect of these cannot be strictly compared with that of a number of small lamps upon the basis of the minimum effect alone. They give much more light in places than the small lamps; and it has been a question among specialists whether the excess of lighting round the bases of the columns of the powerful lamps should be reckoned in the comparison of their useful effect as against smaller lights. M. Wybauw and others will not recognize this superabundance of lighting at all; because they argue that it is wasted, and that a place is never lighted better than in its darkest spot. Others, and especially electricians, claim that the lighting even of superfluously brilliant spots should be taken into consideration. M. Weissenbruch chooses the middle course, and introduces the two elements of mean and minimum lighting in his calculations relative to the lighting of railway stations in Belgium.

Passing from considerations of outdoor lighting to those related to the lighting of interiors, Dr. Palaz admits that if the problem of the lighting of a horizontal plane by means of many sources is difficult, that of the lighting of interiors is particularly complicated. He makes the general observation that the lighting of a hall depends in reality upon many factors, amongst which the illuminating power of the lights employed does not play the preponderating part which might be imagined at the first glance. Beside the lighting effects, there is another element to consider, which M. Wybauw calls the *illumination effect*, which is really a consequence of the lighting, strictly so called, but is not related to it in any definite proportion, and is able to modify, in a fashion often very important, the final judgment passed upon the lighting of halls. The numerous flames of a lustre create an impression of brilliancy superior to that given by a single light of the same illuminating power. Two gas-flames, or two electric lamps, may differ greatly in illuminating power; but when they are not absolute neighbours, they both produce the same effect upon our eyes. The light of a simple candle is visible by night to a considerable distance, even to 500 yards or more, while its illuminating effect is not perceptible upon objects at such a distance. It is the same with a white wall lighted at night. A line of "Vauxhall lamps" placed thickly along the *facade* of a house on the occasion of a general illumination, produces at a certain distance absolutely the same effect as a line of gas-jets of much greater illuminating power. These *illumination effects* have no measure in common with the intensity of lighting; but since they go to affect the ultimate results, they must not be lost sight of.

Diffused light is also an important element in the lighting of interiors. Really, it has a utility greatly in excess of what can be ascribed to it as a result of measurement of quantity, in comparison with simple, direct light. In a hall illuminated by gas-flames enclosed in opal globes, the eyes are deceived by appearances into crediting the lighting with more brilliance than it actually possesses, as an attempt to read a book or a newspaper will show. A diffusing surface becomes, when lighted, a source of light from every part of its area. If a mirror is placed behind a light-source, the apartment appears to be lighted by two sources. If the glass is replaced by a white wall, the effect is much more striking, although, in reality, the light reflected by the dull surface will be of less intensity than that reflected by the mirror. All bodies reflect light, but with exceedingly varying intensity, according to their distance from the source, their colour, and the degree of polish or roughness of their surface. This diffused light is a powerful auxiliary to the lighting effect produced by direct light. It is its diffusion which gives daylight its enormous superiority over artificial light. The latter only illuminates objects according to one direction; leaving their sides or opposite faces in a strong shadow, which is but feebly reduced by the artificial light reflected from surrounding objects.

It is difficult to take full account of the enhancement of lighting produced by diffusion from the ceiling or walls of an apartment. M. Mascart attacks the problem mathematically upon the assumption that the proportion of light diffused is analogous to the reflection from a polished surface, and which in some instances amounts to 90 per cent. Without assigning any numerical value to the coefficient f of diffusion, let us suppose that a system of lamps placed in an interior radiates a total quantity of light Q. A portion of this light is definitely absorbed by the walls, and the other portion fQ, being diffused, spreads anew through the room. The second diffusion gives in the same way a quantity of light which can be represented by f^2Q, and so on; showing the total light used to be $Q(1 + f + f^2 + \ldots) = Q\frac{1}{1-f}$. The mean brilliancy of a sheet of paper placed in any position will be, with black walls, proportional only to the quantity Q of light emitted by the lamps; and with walls having a reflective power f, it will be proportional to the quantity $Q\frac{1}{1-f}$. The enhancement of the lighting is therefore represented by the ratio $\frac{1}{1-f}$. If we take $f = 0{\cdot}95$ as the extreme diffusive value of white walls, the apartment will appear to be *twenty times* as brilliantly lighted as when the walls are black. It is doubtless seldom that such a high value is actually reached; but the benefit of white walls to the general lighting is not far short of this.

(*To be continued.*)

The Electric Lighting Scheme for Brussels.—In connection with the particulars given in another column in regard to the gas undertaking of the Brussels Municipality, it may be mentioned that the Technical Committee of the Council who had to examine the various tenders submitted for carrying out a scheme of electric lighting in the city have decided to recommend the acceptance of that of the India-Rubber and Gutta-Percha Telegraph Company, of Silvertown. The decision has, we learn, given rise to much criticism.

NOTES.

Mr. John Aitken on Steam Condensation.

Mr. John Aitken, F.R.S., is continuing his interesting and valuable researches upon the composition of clouds and mists, and the various phenomena related to the presence of dust in the atmosphere. He recently submitted to the Royal Society another communication bearing upon the general subject, but specially relating to some phenomena of cloudy condensation. It has already been placed upon record that Mr. Aitken has found gas-flames to be prolific sources of dust in the atmosphere which receives their products of combustion; and he has now corroborated the observation by fresh experiments with gas-flames and steam-jets. He was studying the condensation in air of steam-jets, and trying various means of causing this process to become more dense than it generally is; and, among other influences, he applied that of flames. He found that flame itself had no effect on the steam-jet; but on bringing the products of combustion into the jet, it at once became dense, and remained so as long as the supply was kept up—the jet having exactly the same appearance as when electrified. When in this condition, electricity does not increase its density any further. The increased density is here due to the large number of dust nuclei, causing a great increase in the number of water drops, which are very small, and therefore do not come into mutual collision, which would otherwise reduce their number. Other experiments which have been carried out point to the same conclusion—that the increase of the density of the cloud of steam is due to greater number, and not to greater size of the drops.

A Method of Measuring Light and Colour.

At a recent meeting of the Physical Society, Mr. Joseph W Lovibond read a paper upon a suggested unit for the measurement of light and colour; and he exhibited an arrangement for employing the unit in practice. The principle of the measurements depends upon the selective absorption of constituents of normal white light by coloured glasses—red, yellow, and blue. The depths of the tints of these glasses are carefully graduated to give absorptions in numerical proportions. For example, two equal glasses, each called "one-unit red," give exactly the same amount of absorption as a "two-unit red," and so on. The units of red, yellow, and blue are so chosen that a combination of one of each absorbs white light without colouring the transmitted light. Such a combination is called a "neutral-tint unit." By the use of successive neutral-tint units, white light can be gradually absorbed without showing traces of colour; and the number of such units required to produce complete absorption is taken as a measure of the intensity or luminosity of the white light. Various results in colour-matching and measurement are found to be attainable by this method, which was shown in use by Mr. and Miss Lovibond.

A Strange Pipe-Line Project.

One of the latest and perhaps most startling of all the pipe-line projects yet mooted is that for the conveyance of coal from the Pennsylvanian pits to the Atlantic seaboard, in the form of a mixture of finely-powdered dust and water. The scheme has been quite seriously put forward in several New York newspapers; the idea being that the coal is to be ground at the pit's mouth into a powder as fine as flour, then mixed with water in equal parts, and the mixture pumped into pipe-lines leading to the port of shipment, exactly as petroleum is treated now. The fluid is to be received in large settling-tanks at the end of its journey, when the coal dust is to be allowed sufficient time to deposit, after which the water is to be drawn off, and the damp dust collected for use, either as it is, or after having been moulded into briquettes. The object of the scheme, as stated by its promoter, is reduction in the cost of transportation, with consequent cheapness of the coal to the consumer at a distance from the coal-fields. Several American technical journals honour the project with an argued refutation, although it might be thought that the absurdity of the notion would have been obvious.

The Recovery of Sulphocyanate from Gas Purifying Material.

Herr J. V. Esop has communicated to the *Chemische Industrie* a memorandum upon the occurrence of sulphocyanic acid in illuminating coal gas. He remarks that the dry distillation of coal engenders, besides ammonia, hydrocarbons, phenols, &c., a distinct class of nitrogenous bodies—such as cyanogen and its derivatives—in quantity not negligeable. De Romilly explains the formation of cyanogen by the action of ammonia upon carbon at a red heat. Herr Esop does not stop to discuss this theory, but proceeds to deal with the best means of recovering the cyanogen compounds from ammoniacal liquor and the products of coal gas purification. The proportion of cyanides in coal gas depends upon the method of manufacture; it appears to increase with the weight of the charges in the retorts. While the crude gas preserves a temperature above 100° C., the cyanogen and the ammonia remain separate; but as soon as the temperature falls below 80° C. in the apparatus, there is a formation of ammonium cyanide, sulphocyanate, and ferrocyanides (by contact with salts of iron in the purifiers). In the ammoniacal liquors of the gas-works of Wiesbaden, Carlsruhe, and Mayence, Herr Esop has found, from the distillation of Saar and Ruhr coals, from 1·22 to 2·33 grammes of sulphocyanic acid and from 18·05 to 36·05 grammes of ammonia. In the spent materials of purification as much as 4·25 per cent. of sulphocyanic acid, 4·38 per cent. of ammonia, and 4·38 per cent. of ferrocyanide of potassium has been found. On the average, the spent purifying masses contain more and purer sulphocyanic acid than the ammoniacal liquors. By methodical extraction and concentration, it is generally easy to obtain crystallized sulphocyanate of ammonia. If the washings are very impure, and but little charged with sulphocyanate, it is better to isolate the sulphocyanic acid by means of its insoluble cupric salt. To make the best use of the spent purifying materials, it is necessary to preserve their soluble salts by keeping them in covered stores, in layers not too thick and at a low temperature. If their temperature rises above from 16° to 20° C., their green colour passes into red, they disengage an acrid odour, decomposition spreads through the layers, and in a few days the sulphocyanate is nearly all decomposed. In these conditions, the sulphocyanate is transformed partly into ferrocyanide and partly into volatile compounds which are lost. Spent purifying material contains sulphocyanate of ammonia, chiefly in the state of microscopic crystals very irregularly distributed. It is often found enclosed in hard lumps, stuck together by moisture or by tar. For good working, it is necessary to crush these lumps, in order that the soluble salt should be washed out. The material is treated by soaking in fresh water, pressing the insoluble residue, and digesting it again in another bath. If the sulphocyanide and ferrocyanide are to be extracted at one operation, alkaline lessives are used hot, in closed vessels, in order to catch the ammonia, which comes off abundantly. If the washings are tolerably pure, they are fractionally distilled at once; if they are too impure, the sulphocyanic acid is isolated with a copper salt, generally the sulphate. The sulphocyanate of copper is washed and transformed into an alkaline salt by the addition of a corresponding sulphuret—whether of potassium, calcium, barium, &c.—the copper being recovered for use over again.

Coal and Coke Duties in Russia.—Information received at the Foreign Office from Her Majesty's Chargé d'Affaires at St. Petersburg is to the effect that the duty on coal imported by the Black Sea and the Sea of Azov is fixed at 4 copecks per pood, instead of 3 copecks and 40 per cent.; and that the duty on coke imported by the same seas is fixed at 5 instead of 4½ copecks and 40 per cent.

The Birmingham Water Scheme.—It seems that the Birmingham Corporation Water Bill is to be strongly opposed in the House of Lords. According to the *Daily Chronicle*, Lord Rosebery has been asked by the Special Water Committee of the London County Council to move a resolution on the second reading of the Bill. Its terms are that "in view of the possibility of its being ultimately established that the present sources of supply cannot be extended, and that additional sources are required, and in view also of the fact that the possible fresh areas of supply are limited, and are already being drained for other large communities, Parliament may well consider, before granting any powers for further encroachment upon those areas, how far provision ought fairly to be made for the possible requirements alike of the Metropolis and of other large populations upon the lines of supply."

The Measurement of High Temperatures.—In connection with the exhibition by Professor Roberts-Austen, at the first *conversazione* for the present session of the Royal Society, of M. Le Chatelier's optical pyrometer, to which reference was made in the JOURNAL for the 10th ult. (p. 845), attention may be directed to a paper on the "Measurement of High Temperatures," read by him at a recent meeting of the Institution of Civil Engineers. The object of the communication was to show that measurements of high temperatures can be readily and accurately effected. The author did not attempt to give the history of pyrometric methods; but from the various appliances which have been devised, a few modern examples were selected, the use of which was justified by experiment. These depended on the measurement of heat either by the aid of electricity or by optical methods. Siemens, and more recently Callendar, had, he said, shown that very trustworthy results might be obtained by employing the increased resistance of a platinum wire, due to heating it, as a measure of the temperature to which the wire was raised. On the other hand, Professor Le Chatelier had perfected the use of thermo-junctions, the electrical equilibrium of which was disturbed by heat, and the measurement of the difference of potential thereby produced afforded a means of ascertaining the temperature to which the junction was subjected. The author then described at length his method of rendering the indications of the Le Chatelier thermo-junction self-recording, and incidentally compared the testimony afforded by an air thermometer and by a thermo-junction as to the temperatures of highly-heated bodies. The new optical pyrometer above alluded to, which is based upon the photometer of Cornu, was described at length, and a series of measurements of high temperatures made by its aid were given.

COMMUNICATED ARTICLE.

COAL GAS: ITS MANUFACTURE, DISTRIBUTION, AND CONSUMPTION.

A Series of Articles for Gas Students.

(*Continued from p.* 1058.)

Several modifications have been introduced into annular condensers. For instance, Messrs. C. and W. Walker construct them of wrought iron, and dispense with the bottom box altogether; thus reducing the weight of the apparatus to probably less than one-half that of the original pattern. They retain the diagonal pipes connecting the upright annular pipes, but use them on both sides of the apparatus, so as to ensure the perfect circulation of the gas around the annular space. They also introduce into one column of the series a number of screens, through which the gas passes; the tar being there, in great part or wholly, separated. Cutler's and Dempster's condensers are also of wrought iron; but these makers arrange the connecting-pipes alternately at the top and bottom of the columns, so that the gas, entering at the bottom end of the first pipe, passes upwards to the top, and through the short connection into the top of the second column, down which it flows, and so on alternately up and down the columns until the outlet is reached.

Mr. W. J. Warner has introduced a mid-feather, or partition, into the annular space, which reaches to within a short distance of the top and bottom ends. The gas, entering at the bottom of the column, passes upwards on the inlet side of the partition and over the top, down on the opposite side, to the outlet of the column, and through the connection to the base of the next column, where a similar course is again taken. The partition is carried down sufficiently to be sealed in the liquid, which thus has no obstacle to its free passage along to the liquor outlet.

The Ordinary Plain Pipe Condenser.

This is well known, and will be found in most small and in not a few of the larger works whose engineers prefer the simpler apparatus.

The vertical form consists of a series of upright pipes, rising from a cast-iron box or closed trough. They are connected at the top in pairs by ∩-shaped bends (usually fitted with plugs for cleaning), bridge-pipes, or, when but of small diameter and of wrought-iron, not unfrequently with a wrought-iron cross fitted with nipples or short pieces and plugs—a plan which greatly facilitates the cleaning of the tubes. In the trough below, all the products of condensation are collected and run off by a suitable outlet-pipe to the tar and liquor well. The troughs may be made separate—one for each pipe, or, as is usually the case, they may be constructed in one continuous length, and be provided with baffle-plates or diaphragms placed at intervals to direct the right passage of the gas into the proper pipes, and prevent it travelling directly along the trough. In this case, the liquor outlet will be fixed at such a level as to ensure that there is always a certain depth of liquor in the trough. The diaphragms or baffle-plates referred to will dip into this liquor; and they are made sufficiently deep to provide only the necessary seal. Thus they do not present any obstacle to the easy flow of the condensed tar and water.

The passage of the gas through the apparatus is therefore from the inlet up pipe No. 1, down No. 2, into the trough. A baffle-plate here prevents further passage along the trough; so the gas goes up No. 3 and down No. 4 into the trough again, when another baffle-plate directs it up No. 5, and so on right through the series until it reaches the outlet-pipe. A somewhat similar arrangement to the bottom trough can be applied, if desired, at the top ends of the vertical tubes, in place of the connections referred to. In this case, there will be fixed a cast-iron trough, through the bottom of which the top ends of the tubes will pass, and project some inches upwards. The trough is filled up to the level of the tubes with water, which is afterwards displaced by the liquor of condensation. All that is now necessary to correctly direct the flow of gas is, instead of using the ∩-tubes or other connections, to cover the successive pairs of pipes with cast-iron hoods, sealed in the liquor referred to. To remove them for cleaning out or examining the pipes when required, is but the work of a few minutes.

In the horizontal form, the pipes are arranged almost horizontally, one above the other up a wall, or on a frame especially constructed for carrying them. A gentle inclination is given to the pipes, and they are connected at the ends by ⊃-shaped bends. There is thus a gradual fall from the top pipe to the bottom one; and an easy flow provided for all the products of condensation.

The pipes are sometimes connected together by T-pieces, the flanged branches of which, on either pipe, are brought face to face, and bolted together; the connection forming the letter I. The ends of the pipes are also flanged, and are closed by a blank flange bolted on. The inlet to the apparatus is, by preference, at the top; the gas passing down the top pipe, then back by the ⊃-tube or other connection along the next below, and turning and re-turning again through each successive pipe—finally leaving the apparatus by the gas outlet at the bottom. The condensed tar and liquor follow the same direction, and are carried away by a separate outlet. This simple form of condenser may, if the pipes are of sufficient diameter and length, be employed exclusively, or they may be used in conjunction with the annular condenser; the latter assisting in graduating to the required degree, the ultimate temperature of the cooled gas.

Cleland's slow-speed condenser is a vertical tube condenser but differs materially in construction and work from all others. The apparatus consists of a series of upright tubes resting in, and open to, a box or trough, and having an inlet-pipe running along the top, and open to all the verticals. Thus the gas is subdivided, and freely and slowly passes down the various tubes to the boxes, where it enters an outlet also connected to all the upright pipes. The inventor calculates that the gas is quite cool on arriving to about two-thirds the depth of the pipes; and from this point to the bottom it is fitted with arrangements for washing the gas, and depriving it of the whole of the tar and much of the ammonia.

The Battery Condenser.

This is a cast-iron box or vessel divided at intervals by internal plates, which extend to the top and bottom of the box alternately. In the chambers thus formed, a large number of tubes are fixed from side to side, and open at either end to the atmosphere outside. The gas entering at the inlet is caused, by the intervening baffle-plates, to pass alternately up and down the various chambers; and it is further cooled by contact with the air-tubes referred to. Moreover, these tubes and the baffles serve also to break up the gas, and tend to aid much in the deposition of all condensable matter. The apparatus is very efficient; and its power can be regulated at will by putting in or out of action, as desired, more or less of the cooling-tubes.

Water Condensers.

The use of water for cooling the crude gas is more simple of application than the atmospheric system, and will not require much space for its consideration. The most important principle to be borne in mind is that *the cool water must meet the cooled and not the hot gas;* thus obviating a too rapid condensation, and the consequent deposition of the hydrocarbons. The water will therefore enter the apparatus at or near the gas outlet, and, as it proceeds and meets the hot gas, it gradually absorbs its heat, and ultimately leaves the condenser at or near the inlet at a temperature not far below that of the crude and uncooled gas itself. The process of cooling will thus be very gradual, and can be readily adjusted to meet any requirements or any gradation of temperature.

Messrs. Morris and Cutler's "Perfect" condenser is of this type. It consists of a cast-iron box, divided at intervals by a series of horizontal baffle-plates, not so long as the case; the intervening spaces alternating at either end of the condenser. The crude gas, entering at the bottom, goes along the first chamber, until reaching the end of the first baffle-plate, it passes upwards and flows in the opposite direction, along the next chamber, and so on, following a zig-zag direction right through the series, until it emerges from the apparatus at the top. Water-pipes, entering the condenser at the top, follow precisely the course taken by the gas, only in exactly the opposite direction; thus meeting it all the way, and becoming hotter and hotter until it finally leaves the condenser at the bottom. The water not having come into contact with the gas in any way, it is uncontaminated, and fit for use in the boilers, or for any other purpose for which hot water may be required.

Mr. Livesey places his condensing-pipes in a tank of water, which is divided into channels. The amount of water can therefore be easily regulated at will in accordance with the varying requirements.

Pelouze and Audouin's Condenser.

The principle of this condenser is the breaking up of the gas into very minute streams, whereby it is not only efficiently cooled, and ordinary condensation secured, but much, if not all, of the suspended tarry matter that escapes deposition by simple cooling is broken down and deposited. The condenser consists primarily of three concentric cylinders; an outer cast-iron one forming the case, and provided with the usual inlet and outlets, with the necessary tar and liquor outlet-pipes; and two inner cylinders, both of which are perforated—the inside one with very finely-divided perforations, the outer one with slots, and so arranged that the blanks are opposite the perforations of the inside cylinder. The gas issues through the latter in very finely-divided streams, dashing against the blank portions of the second cylinder. The globules of tar are here thoroughly broken, and flow downwards to the liquor outlet; the gas passing through the slots to the outlet chamber.

Carburetting Apparatus.

Carburetting apparatus, such as Young and Aitken's, the St. John, and others, are generally referred to in this connection; but, in view of the steps now being taken, in the Metropolis and elsewhere, for the adoption, in practical work, of various types of carburetters and enrichers, the writer prefers to postpone for the present the consideration of this matter, in order to give the whole question, in a supplementary article, the full discussion its importance demands. Meantime still further developments and improvements will doubtless be introduced.

(*To be continued.*)

TECHNICAL RECORD.

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Quarterly Meeting at Rugby.

As already briefly recorded in the JOURNAL, a general meeting of this Association was held at Rugby on Thursday, the 26th ult.; and the Directors of the Rugby Gas Company kindly granted the use of their Board-Room for the occasion. Mr. Lawrence (the Vice-Chairman of the Company) and Mr. Wrattislaw (the Secretary) were present, with Mr. Simpson, to welcome the party on their arrival.

On the PRESIDENT (Mr. W. Littlewood, of West Bromwich) taking the chair,

Mr. WRATTISLAW said they were glad to see the members of the Association at Rugby. The Rugby Gas-Works had been carried on since 1838, when gas was sold at 12s. 6d. per 1000 cubic feet; and they were now selling it at 3s., less a discount of 2d. Under the management of Mr. Simpson, the Company had progressed with the age; and it had been one of the objects of the Directors to consider the consumers as well as the shareholders. There were some things of local interest which Mr. Simpson would later on show the members of the Association; and if the Directors of the Company could do anything to promote the objects of the Association, he believed they would be glad to do it. They were indebted to the Association for the information mutually imparted to the members by each other, and which bore on the advancement of the gas industry.

Mr. LAWRENCE said, in the unavoidable absence of the Chairman, he might express the hope that the members would have an enjoyable day and fine weather. They had only to walk into the School Close to see "Young England" at play; and at the cement works, where they were going later on, they would see "Young England" at work; and they would perhaps be impressed with what Rugby people could do as boys and as men. The Rugby Gas Company were likely to sustain a great loss by the imminent retirement of Mr. Simpson, their Manager, after a lengthened service with them. In the 38 years Mr. Simpson had been at Rugby, he had enjoyed the respect of high and low, rich and poor. He (Mr. Lawrence) had had the pleasure of sitting at different times on various committees with Mr. Simpson; and if ever a practical man was wanted for any practical purpose, Mr. Simpson was the man whose knowledge they fell back upon. He had great tact, and admirable judgment; and it would be a difficult thing for the Rugby Gas Company to replace him. But it would be unkind of them to wish him to abstain from that well-earned retirement he so richly deserved.

The PRESIDENT said that the members of the Association would agree with him that they were sincerely obliged to the Rugby Gas Company for their invitation to hold their meeting at their offices. It must be gratifying to them as gas managers to hear such high words of praise spoken of one who was a member of their Association, and of their profession. It was to be hoped that the Rugby Gas Company would not suffer pecuniarily by Mr. Simpson severing his connection with them as their Manager; but that they would be able to find some one to carry on their works for them with as much success. He thought it was only right that they should pass a vote of thanks to the Rugby Gas Company for their invitation to meet at their offices.

Mr. W. NORTH (Stourbridge) moved a resolution thanking the Company for their kindness in allowing the Association to meet at their offices and for providing light refreshment for the members.

Mr. T. S. CRANMER (Stratford-on-Avon) seconded the motion, which was carried, and briefly acknowledged by Mr. LAWRENCE.

The HONORARY SECRETARY (Mr. C. Meiklejohn) then read the minutes of the previous meeting, which were confirmed.

THE PRESIDENT'S ADDRESS.

The PRESIDENT: The next business is that of reading my address to you. It is usual for the presidential address to be read at the first quarterly meeting of the year; but unfortunately I was unable to attend, owing to serious and sudden illness, to which for some years I have been liable. I thank you sincerely for the resolution of sympathy with me embodied in the minutes of the last meeting; and I will now proceed with the address itself. [This was given in the JOURNAL for the 31st ult., p. 1012.]

At its close, Mr. SIMPSON proposed a vote of thanks to Mr. Littlewood for his address. They all, he said, regretted very much Mr. Littlewood's inability to be present at the last meeting; and they ought to return him their hearty thanks for the address he had that morning given them.

Mr. W. NORTH seconded the motion; and it was carried with applause.

The PRESIDENT said that, when the members elected him, he told them it would be his endeavour to carry out the duties to the best of his ability; but that he hoped they would bear with him in his infirmities. He thanked them for the hearty vote they had just given him for his address.

THE MONIER SYSTEM OF CONSTRUCTION.

Mr. P. HUTCHINGS read a paper on this subject, and began by explaining that it was to have been read by Mr. T. C. Hersey, who had made himself acquainted with the Monier system, from personal inspection of works carried out on the Continent; but, unfortunately, this gentleman was unable to be present. He (Mr. Hutchings) therefore proposed to give the members a few particulars of what he had himself seen. He then went on to say that the system had been named after the inventor, M. Monier; but that it had been developed and perfected through the energy and skill of Herr Wayss, a celebrated engineer and architect of Berlin. In combining iron and cement in the manner described in his patent, M. Monier had created an entirely new building material.* Bricks, stone, cement, or concrete, used by themselves, are only capable of resisting pressure; whereas cement or cement concrete, in conjunction with iron, will resist pressure as well as tensile strains. Another important feature of the combination is that iron and cement concrete unite firmly, and act together as a whole, owing to the fact that the expansions and contractions of both are the same. This being the case, constructions on the Monier system are fireproof and impervious to atmospheric influences. Floors (with either flat or arched ceilings beneath) on this system are capable of supporting considerable loads. The author cited an example of bridge construction with the Monier system. It was built for the accommodation of foot passengers at the Bremen Exhibition of 1890. The arch was made in 36 hours; and the whole construction, with abutments, stairs, platforms, &c., was carried out within six weeks. The width of the span was 131 feet; the pitch, 14 ft. 9 in.; the width in the centre, 9 ft. 10 in., gradually widening to 26 ft. 3 in. at the abutments. The thickness of the arch at the crown was 10 inches; at the abutment, 21½ inches. The safe load (calculating for a six times heavier load) was about a ton per square yard. Passing on to deal with the system as applied to the construction of conduits for water, sewage, &c., the author stated that Monier pipes are found to be cheaper than those of stoneware; while tests have shown them to be far stronger than ordinary glazed or iron pipes. The Engineer of the East London Water-Works Company (Mr. W. B. Bryan, M.Inst.C.E.) had, he said, inspected in Berlin the method of making the Monier pipes of all diameters, from 6 feet downwards; and the result had been a decision to have about 1200 yards of 24-inch for the Lea Bridge station of the Company. Coming to the adaptability of the system to gas-works construction generally, the author said the best proof of its utility was the fact that it had been employed in several Continental works in the building of gasholder tanks; and he thought his hearers would agree that, from the lightness and strength of the construction, it would be specially well suited for the purpose. With regard to cost, he believed it would compare most favourably with that of brick and iron tanks constructed in England. He was unfortunately unable to give definite particulars as to this matter; but the cost was certainly much lower. He quoted largely from testimonials in favour of the system, and gave a list of places where it had been employed. In conclusion, Mr. Hutchings invited the members to inspect a number of protographs taken from works, either complete or in course of erection, on the Continent, which would, he said, speak for themselves to a body of practical men.

In the course of the subsequent remarks of members,

Mr. CRANMER said he thought that this paper on the Monier system would be acceptable to the members, and very suitable on the present occasion, as they were about to visit two of the works in the neighbourhood where cement was made. Mr. Hutchings was not an engineer, and was not able to give them the information Mr. Hersey might have done had he been there; but the details in the paper just read would no doubt be of interest to them. He had seen some pipes, conduits, and specimens of work constructed on the system; and he believed that, for constructive purposes, the Monier system would come to the front. It was simple in construction, and very strong; and it must be cheaper than ordinary brick and cement work. He thought it was applicable in buildings such as retort-houses; and many large buildings had already been constructed abroad. He did not see why they should be behind people abroad in such a matter; and he believed there was a great opening for the use of the material in this country. It was very useful, among other things, for covering subways, where space was valuable. Sometimes, they could not get down as deep as they would like for certain purposes; and the system would come in useful in the saving of space compared with other material. The wires in the Monier system were interlaced; and, where they crossed, they were bound together. Besides the strength given to the material, there was a certain amount of pliability, which prevented the cement cracking.

Mr. MEIKLEJOHN asked if the wires which ran through the cement were continuous, or (if not) how were they joined? Were they laced by smaller iron wire, or simply placed side by side?

Mr. HUTCHINGS showed in an illustration the way the rods ran; pointing out that certain of the rods would be continuous.

Mr. G. WINSTANLEY (Coventry) said he had had some experience in laying concrete floors. The thickness he used was 4 inches. The material was simply laid flat between iron girders, and that had been also followed out in covering subways, with the result that, with any weight they liked to put over it, it was perfectly safe. He thought the Monier system was adaptable

* A description of the system will be found in the JOURNAL for Dec. 8, 1891 (p. 1035).

o gas engineering work, having had much experience in concrete work in floor construction; but in his case the work was at and not curved or arched, as shown in the photographs.

Mr. HUTCHINGS said he believed that would be so; but in this case there was a body of work with iron rods running through it, and less thickness was sufficient.

Mr. WINSTANLEY said he did not see the necessity of the wires overlapping.

Mr. V. HUGHES (Tipton) asked if it required special men to lay the material? [Mr. HUTCHINGS: No.] Did they send out the material ready to hand, and leave it to others to use it?

Mr. HUTCHINGS said the Company might send out men in some cases; but ordinary work could be done by ordinary men with a little supervision.

The PRESIDENT said he was sure they had all listened with pleasure to the paper submitted for discussion. It was especially interesting from being read in a town noted for its cement; the Monier system being dependent on cement and iron for its construction. Abroad, the system had no doubt been considerably used in the construction of large buildings of various kinds; and he believed in some gas-works. Personally he had no experience of it; but he could see very clearly from the materials of which it was constructed that, with judicious application, it must be of great utility under certain circumstances. Mr. Winstanley spoke of what they all knew was very generally adopted in this country for fire-proof flooring and railway work, and other purposes. He rose, however, not to go into the question, but to ask them to pass a vote of thanks to Mr. Hutchings for reading the paper.

Mr. W. WINSTANLEY (Newcastle, Staffs.) seconded the motion; which was passed, and acknowledged by Mr. HUTCHINGS.

This concluded the business of the meeting; and under the guidance of Mr. Simpson, the party afterwards visited Rugby Schools (founded in 1567), which it was stated has a roll of 499 boys. The Chapel contains memorials to old Rugby Scholars who fell in the Indian Mutiny and the Crimean war—a number of the boys going straight from the school to the Crimea. The chair and table of Dr. Arnold, whose connection with the school is so well known, were inspected with some interest. Carriages were in waiting near the school, and the party then started for a drive through the charming scenery of the neighbourhood—fresh and bright with its spring tints. The members subsequently divided into two parties, one going to the Old Rugby Cement works, and the other to the Newbold Cement Company's works. At the respective works, the process of the manufacture of cement was fully seen, and the great strength of the cement was exhibited by tests. Thanks were expressed on behalf of the Association for the great courtesy shown to the members. Mr. Simpson entertained the party at dinner at the Gas Offices on their return to Rugby; the excellent viands in the *menu*, it should be noted, being cooked entirely by gas. The chair was occupied by Mr. Simpson, and the vice-chair by the President of the Association (Mr. Littlewood); and a list of toasts suited to the occasion was duly honoured.

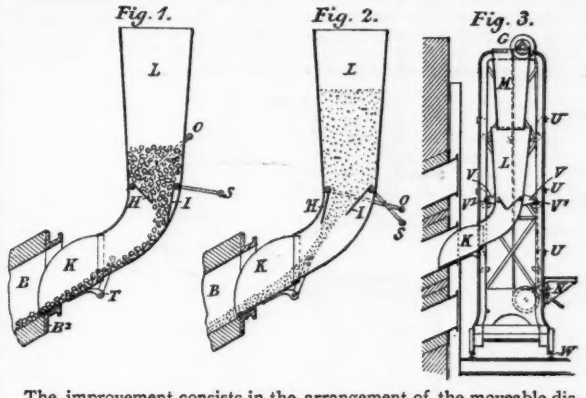
The Work of the Patent Office in the Past Year.—According to the ninth report of the Comptroller-General of Patents, recently presented to Parliament, 22,888 applications were made last year, against 21,307 in 1890; showing an increase of 7½ per cent. The total income of the office from all sources amounted to £203,520, of which £181,777, or 89 per cent., accrued from patent fees. The expenditure, including £21,703 devoted to new buildings, amounted to £103,180; leaving a surplus of £100,339. Of the total spent, £54,267 went in salaries and wages.

A Long Span of Trussed Water-Pipe.—A few years ago, it was necessary to carry an 18-inch water-main across Blackwater Creek at Lynchburg (Va.). The manner in which the work was done was described and illustrated in a recent number of the *Engineering Record*, from which the following particulars are taken: There were two existing stone piers 100 feet apart, on each of which rested a nest of columns supporting an iron bridge. In order to make use of these piers to carry the water-pipe over, the pipe and trusses had to be built so as to occupy a space between the struts, ties, and braces of the iron bridge, without, however, touching any part of the bridge. Additional columns were placed on these piers, and made high enough to leave a clear passage for railroad traffic under the water-pipe, which partly rested on the latter columns. Each end of the pipe was made to rest on a stone abutment. From these supports, the 18-inch cast-iron pipe and its load was carried—4-inch eye-bars being used to truss the pipe; and, changing the strain from flexure to direct compression, utilized the material of the pipe itself as a strut. As the trussing was made to cross from above the pipe to below it, it occupied very little space, and enabled the vertical posts to be short enough for the use of cast iron. Owing to the great length of pipe (235 feet) exposed to the atmosphere, an expansion joint was provided; and the ends were firmly secured to the adjacent rocks by means of 4 in. by 1 in. bars. Ever since its completion, the pipe has conveyed water, under a pressure of 140 lbs. per square inch, without a leak. The truss bars were 4 in. by 1¼ in.; and, with the pedestals, saddles, and piers, weighed scarcely one-fourth as much as the pipe, the joints of which were flanged, faced and bolted together.

REGISTER OF PATENTS.

Charging Inclined Retorts.—Boult, A. J.; communicated from A. Klönne, of Dortmund, and F. Bredel, of Milwaukee, U.S.A. No. 9318; June 2, 1891.

The improvement in charging inclined retorts which forms the subject of the present invention consists in a particular construction of charging-machine G, the particular features of which are shown detailed in figs. 1 and 2. Fig. 3 is a view of the frame supporting the charging-machine.



The improvement consists in the arrangement of the moveable discharging gates H I, which enable materials of different degrees of fineness to be charged. If fine material is to be charged (as shown in fig. 2), the gate H is opened by a lever O; thus giving the material free entrance and high velocity upon leaving the charging-hopper L and shoot K, and when entering the retort B. If coarse or lump material is to be charged, the gate I is opened by the lever S (as shown in fig. 1), thereby causing the material to change its direction and letting it slide slowly down the lower part of the charger L and shoot K and enter the retort B at a moderate speed. If necessary to charge the retorts more fully either in front or back, on account of the different heats of the retorts, this can be effected by varying the opening of the gates H and I.

The apparatus is supplied with the material to be charged by suitable means, and preferably from above. To prevent waste of material in filling the hopper L, a funnel M is arranged in such a way that it will not interfere with the charger when the upper retorts are charged. If the lower retorts are to be charged, the material can either drop from the funnel M into the charger L, or a telescoping arrangement can be made, which will prevent dust from flying around. The charger can be raised or lowered by hoisting mechanism N. A frame (with automatic stops U engaging with projections V) is provided to keep the charger and shoot in their respective positions to the height of the charging mouthpiece or opening B². The shoot is moveable upon a pivot T, so as to enable it to be adjusted, and admit of the charging apparatus being run freely on rails W in front of the charging mouthpieces. The charging apparatus G may be arranged to hold one or more charging-hoppers L, and more than one can be charged at the same time.

Pipes or Tubes for Liquids and Gases.—Armstrong, J., of West Bromwich. No. 9997; June 12, 1891.

This invention has for its object to make pipes or tubes for conveying liquids and gases (and for protecting and insulating electric conductors and for other like purposes), the internal surface of which is of glass, and having an external support of concrete, cement, pitch, or other like non-metallic material; and, where great strength is necessary, there would be a further covering of sheet metal or wirework, or coils of thin sheet metal, and where the pipes were to be laid underground, a final coating of concrete.

Silencing Boxes for Gas-Engine Exhaust-Pipes.—Bilbie, J., and Hobson, W., of Queen Victoria Street, London. No. 10,047; June 13, 1891.

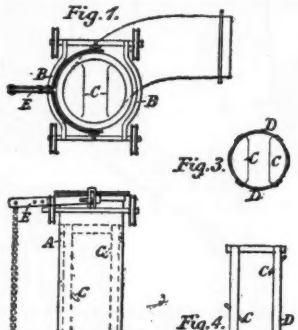
The usual method of silencing the exhaust of gas-engines, the patentees point out, is to place in the ordinary exhaust outlet-pipe one or more vessels of suitable shape and size to allow the gases which escape at a high pressure from the engine to reduce the pressure before reaching the outer air. Another method is to make a pit of brickwork, and fill it with loose stones or shingle. The exhaust passes into this pit; and, not having free exit, the pressure is reduced, and the noise at the outlet silenced. The first of these methods will not totally silence the exhaust; and the second entails considerable expense, while the stones and shingle become pulverized, and have to be frequently replaced.

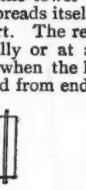
The present improvements consist in providing an expansion chamber of cast iron, and carrying the exhaust-pipe or branches from it a considerable distance into the interior of the box; the end being plugged to form an abutment, so as to receive the rush of the incoming gases. The part of the pipes inside the box at their incoming ends are perforated with small holes of suitable numbers and size, so that their combined area shall be equal to the area of the exhaust, or be otherwise arranged to suit conditions.

Charging Sloping Retorts.—Braidwood, J. F., of West Greenwich. No. 10,902; June 26, 1891.

The patentee explains that, in order to conduct the coal from above—say, from a tipping wagon, such as the one described in patent No. 15,888, of 1890—into the mouth of a sloping retort, and in order to obviate the necessity of an upturned mouth on the retort, he arranges

a moveable shoot of suitable length mounted on a carriage, the wheels of which run on rails along the face of the upper ends of the retorts. The inside of the shoot is provided with a series of baffle-plates, or deflecting surfaces; while the lower end is just sufficiently curved to enter the mouth of the retort. The baffle-plates may be fixed on a framework, which drops into the shoot, and is secured therein or thereon, so that different arrangements of baffle-plates and different sized deflecting surfaces may be interchanged as desired. When the coal is tipped from the wagon into the upper end of this shoot, its rapid descent into the retort is checked or retarded by the baffle-plates; and thus the coal emerges from the lower end of the shoot into the retort at the desired speed, and spreads itself (approximately) evenly right down the length of the retort. The retort can thus be made with the lid mounted either vertically or at any desired angle thereon, at both top or bottom; so that, when the lids are removed, a clear opening in a straight line is obtained from end to end.





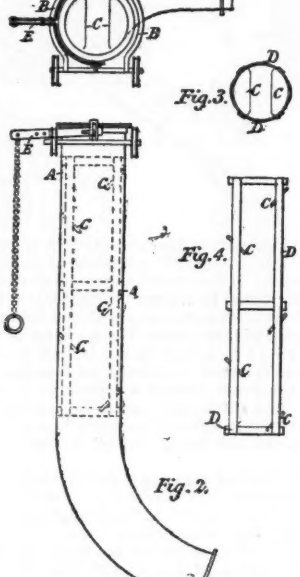


Fig. 1 is a plan of the shoot and wheeled carriage on which it is mounted. Fig. 2 is a side elevation, showing the baffling apparatus dotted in. Fig. 3 is a plan of the removeable arrangement of baffle-plates—removed from the shoot. Fig. 4 is a side elevation of fig. 3.

The shoot A is made curved at the lower end, so as to readily enter the mouth of the retort. At its upper end, it is mounted in a carriage B, having four wheels running on rails; or it may be swung from a crane or derrick, or supported in any other desired manner. The projecting lever E with forked ends (the latter encircling the shoot) is provided for the purpose of raising or lowering the shoot in its carriage, so as to adjust it to the mouth of the retort should the level of the latter vary in any way. The lever is operated by the chain shown, or in any other suitable manner. The baffle-plates C may be permanently fixed in the interior passage of the shoot, or else in an open frame D (fig. 4). Any suitable number of these baffling surfaces are mounted (according to the length of the shoot), and at any suitable angle, so as to ease the descent of the coal, by causing the latter to glide from one baffle-plate or surface C to a lower one, and so on; thus checking the fall, and causing the coal to enter the retort at a reduced speed.

Producing Gas for Motor Engines.—Bènier, L., of Paris. No. 13,870; Aug. 15, 1891.

This invention relates to apparatus for producing a combustible gas composed of carbonic oxide and hydrogen, designed for supplying gas motors or other similar engines, and comprising a closed fire-place charged with any fuel through a closed pipe, and into which the air can pass only through the grate and under determined conditions. An annular space, constantly supplied with water, surrounds the base of the fire-place, and is designed to produce the steam to be injected below the grate; a starting valve communicating with the chimney. Apparatus, if desired, is connected with a cooler formed of small tubes (into which the gas passes), through which a current of water circulates. After having traversed the cooler, the gas leaves through a pipe which has at its end a valve arranged on the engine for the purpose of regulating the introduction of the gas. At the same time that air is drawn by the piston of the engine into the cylinder, a certain quantity of gas is also drawn in through the valve, and, owing to this suction, a certain quantity of air enters the fire-place; and thus gas is formed only as long as the same quantity of gas is introduced into the engine.

Regarding his invention, the patentee remarks: "It is well known that gas-engines utilize heat in the most advantageous manner by transforming it into work. A steam-engine, under good conditions, needs about 1 kilo. of coal per hour and horse power—that is to say, on an average 6000 calories—whilst the gas-engine for the same work requires only 800 litres of gas, or 4800 calories; which constitutes a saving of 1200 calories in favour of the gas-engine. But the 6000 calories of the steam-engine cost only about 3 centimes, whereas the 4800 calories of the gas-engine cost about 16 centimes in the case of lighting gas."

Increasing the Illuminating Power of Gas.—Rudd, J., of Atherton, Lancs. No. 5994; March 28, 1892.

This invention relates to means for increasing the illuminating power of gas by providing a suitable receptacle for receiving liquid such as benzene or other hydrocarbon, the gas of which intermixes or diffuses with the coal gas, as it is passed over the surface thereof before reaching the point of combustion. The receptacle is connected with the supply-pipe from the gas-meter in such a manner that the coal gas, after leaving the meter, passes through a pipe into the receptacle where gaseous diffusion takes place. Instead of the charging receptacle being connected at the gas-meter, as an alternative it may be attached to the gas-jet or other part of the connecting-pipe, so as to prevent the gas passing direct to the burner. It would be only needful to plug or stop the pipe, and provide apertures one on each side of the plug, so as to communicate with the charging receptacle beneath, in order to compel the gas to pass down the first aperture into the charging receptacle and then up the second aperture to the burner, and in doing so to intermix with the gas from the benzene.

APPLICATIONS FOR LETTERS PATENT.

10,063.—Humpidge, H. T., Humpidge, J. T., and Snoxell, G. E., "Gas and oil motor engines." May 27.
10,069.—Pollock, R., "Gas and oil engines." May 27.
10,112. Wall, E., and Frecknall, G. H., "Condenser for use in the manufacture of gas." May 27.
10,194.—Irwin, D. H., and Bradley, H. W., "Igniting apparatus for gas or oil motor engines." May 28.
10,206.—Dowson, J. E., "Gas-heated ovens, chambers, or furnaces." May 28.
10,219.—Doulton, H. L., "Apparatus for softening and purifying water." May 28.
10,246.—Jeavons, W. R., "Hydrocarbon burners." May 30.
10,316.—M'Innes, D., and M'Lachln, A., "Incandescent gas-fires." May 31.
10,328.—Wigham, J. R., "Lighthouse illumination." May 31.
10,402.—Claremont, E. A., "Gas-engines." June 1.
10,444.—Doig, W. B., "Gas-meters." June 1.
10,481.—Ezard, G. W., "Gas-stoves." June 2.
10,485.—Killey, E. W., "Gas-burners." June 2.
10,486.—Williams, H., "Illuminating gas." June 2.
10,605.—Bartlett, J., and Williams, G. A., "Incandescent gas-lamps." June 3.
10,666.—Boult, A. J., "Water-meters." A communication from M. Esser. June 4.
10,683.—Helberger, H., "Automatic calculation of electric, gas, or water distribution." June 4.

Salisbury Corporation Water-Works.—The Water Committee of the Salisbury Town Council are proposing to make some important additions to the plant at their water-works, at an approximate cost of about £4000.

The Public Lighting of Bucharest.—Her Majesty's Chargé d'Affaires at Bucharest has intimated that tenders will shortly be invited for various public works for the improvement of the town; including lighting by gas and electricity.

Main's Gas Cooking and Heating Appliances.—We have received from Messrs. R. and A. Main, of London and Glasgow, an exceedingly well-printed illustrated catalogue of their gas cooking and heating appliances. It is of oblong shape, bound in cloth; and is in every respect worthy of a place among gas managers' works of reference.

A New Reservoir for the Belfast Water Commissioners.—Last Tuesday the Belfast City and District Water Commissioners paid a visit of inspection to their various works; and the event was of unusual interest, as the occasion was taken advantage of to perform the ceremony of laying the first stone in connection with the Leathamstown reservoir. This was done by Mr. John Laird, the Chairman of the Works Committee, who was presented by Mr. L. L. Macassey, the Engineer of the Commissioners, with a handsome silver trowel. The reservoir will occupy an area of about 50 acres, will have a storeage capacity of 120 million gallons, and will cost, it is estimated, £20,000.

The Borrowing Powers of the Rochdale Gas Department.—At the last meeting of the Rochdale Town Council, on the recommendation of the Gas Committee, it was resolved that application be made to the Local Government Board for their sanction to the borrowing of £65,000 for the purposes of the proposed extensions of the gas-works. Alderman Petrie explained that the amount intended to be borrowed had been increased from £60,000—the sum originally mentioned as the estimated cost of the extensions—to £65,000, because, when the plans were finally gone through, it was found that a large gasholder which was to be erected should have four lifts instead of three. This would make it serve the purposes of the Committee a good many years more, at a less capital cost than would be involved in any subsequent enlargement.

Annual Report of the Middleton Corporation Gas Committee.—In moving the adoption of the minutes at the meeting of the Middleton Town Council last Thursday week, Mr. G. Booth commented at length upon the accounts of the department for the year ending March, 1892. He stated that the amount of profit was £340, as against £796 in 1891. The increase in the manufacture of gas was 3,899,000 cubic feet; and in the amount of gas sold, 2,342,000 feet. The leakage was 11·89 per cent., against 10·29 per cent. in 1891. The Gas Manager accounted for this extraordinary figure by the fact that a larger number of gas-mains—something like three miles—had been laid down in the borough, and other small portions had been laid to supply lamps, &c., while a great deal of waste had been caused by the dismantling of one of the old gasholders for the purpose of erecting a new one. The extra cost for coal and cannel had been £198; and they had incurred additional expenditure by increasing the illuminating power. This cost them 2d. per 1000 cubic feet, which, on a make of 80,000,000 feet, made £250. The minutes were passed.

MISCELLANEOUS NEWS.

THE ROYAL COMMISSION ON LABOUR.

Tuesday, May 31.

(SECTION C.—*Present: The Right Hon.* A. J. MUNDELLA, M.P., *Chairman; the* DUKE OF DEVONSHIRE, *Mr.* J. C. BOLTON, M.P., *Mr.* AUSTIN, *Mr.* TAIT, *Mr.* TROW, *and Mr.* MAWDSLEY.)

The Evidence Relating to the Gas Industry.

The hearing of evidence in connection with the gas industry was resumed to-day.

Mr. *G. C. Trewby*, Chief Engineer of The Gaslight and Coke Company, examined by the CHAIRMAN, said the Company was incorporated in 1810, and was therefore one of the oldest gas undertakings in the kingdom. Their authorized capital was £12,000,000. They had 2000 miles of mains, and eleven manufacturing stations, where they carbonized about 2,000,000 tons of coal a year. The number of men employed varied, according to the season of the year, from 5000 in summer, to 10,000 in winter.

The CHAIRMAN: What are the earnings of your men?

Witness: Scoop drivers are paid 5s. 7d. to 5s. 11d.; stokers, 5s. 4d. to 5s. 7d.; and firemen, about 5s. 6d. per day of eight hours.

Is their employment regular?—We have them on a monthly agreement, which requires a month's notice on either side.

What becomes of the extra 5000 men who are employed in the winter?—They are only too ready to leave us in the spring for brick-making and other kinds of employment; but a certain proportion of the men are engaged in the works in repairing the wear and tear, and in the construction of new works. The same men return to us year after year. We keep a character book containing a record of the men's services; so that we can turn back and see when we first employed a man, and what his character has been.

And you think that, with your work and other work, these 10,000 men are fairly regularly employed?—5000 are with us all the year round, and the other 5000 part of the year. We begin putting on new men at the latter end of August, and go on gradually until we reach the maximum in the depth of winter; and then about February we commence to decrease again, depending, of course, on the weather.

I understand that your employment of these labourers is at a time when outdoor work is scarce?—Yes.

Do they work on Sundays?—On Sundays we do not make gas as a rule between six o'clock in the morning and ten o'clock at night. If we have to make gas, we pay double; but, as far as possible, it is discountenanced.

Can you tell us anything about the healthiness or otherwise of this employment; have you any statistics or information throwing light on the general health of the men?—Yes; I have here a report of the Medical Officer of the Company, which gives an account of the health of the men. He says that the average number of sick during the year has been 153. The rate of sickness is 2·5 per cent., as against 2·9 per cent. in the Metropolitan Police. So that practically the gas workers come very near to the Metropolitan Police in point of health.

Will you tell us something about the Workmen's Provident Society?—It is managed by a Committee of the workmen at each station, and a representative Committee at the head office. It is subsidized by the Company to a large extent—in fact, the amount which the Company give is about equal to the pay of the Medical Officers. The men themselves contribute 6d. per week; and they obtain 12s. a week in case of sickness. In connection with this Workmen's Provident Society, we have a Consulting Physician, whom we pay ourselves. Then, in addition to him, there are 28 other medical men in the districts where the works are situated, to whom the men have access in case of sickness or injury. These are appointed by the men themselves.

Do you know what proportion the contribution of the Company bears to that of the men?—I think it amounts to something like 5s. 6d. per man per annum.

I see that the prevailing diseases, according to the report for the half year, are rheumatism, catarrh, and bronchitis. I also see injuries to 45, and burns and scalds to 33; and only one case of infectious disease is reported in the half year?—Yes, that is so.

It may be summed up, may it not, that your men earn, on an average, from 33s. to 35s. a week?—That is without the double time.

And you allow them certain holidays?—Yes; we allow them a week's holiday in the summer time, for which we pay them. We give them leave of absence and a week's pay; and then, in addition to that, in the case of the men who work, we give them a holiday in proportion to the time they have worked. If a man had worked six months, he would get three days' holiday.

Are your men members of Unions?—We do not know who are members, and who are not.

You make no inquiry?—We make no inquiry whatever.

And you do not discriminate between members and non-members?—No; the men are free to join or not. We do not make any inquiry; and all our foremen have strict injunctions not to express any opinion, or interfere in any way whatever.

When did you first begin the eight-hour system?—In 1889. The men said they would benefit very much by having three shifts instead of two; that they would have more time to devote to their homes, and to improving themselves. The Directors then went into the matter to see what it would cost; and it was conceded without demur.

What has it cost you?—It works out to about £70,000 a year.

I suppose the increased expenditure would be put upon the price of gas to the consumer?—To a certain extent. Of course, some part of it comes out of the dividend of the shareholders. As the price of gas is increased, the dividend decreases.

What is the total amount you pay in wages now?—In carbonizing wages, we pay about £260,000 a year.

What are your total wages?—I should think they would be something like £800,000 a year, including wages for carbonizing, purification, wear and tear, and all the labour.

On the whole, are you satisfied with the eight-hours' experience?—Well, I cannot say that we were altogether satisfied shortly after it came into operation; because we found that the men did not do their work so well, and we did not get the same return from our coal. I am bound to say, however, that since last year things have improved; and the men are working in a much more satisfactory manner.

I suppose it necessitated your putting on a number of new men who were not so familiar with the business?—Yes. There were a certain number of men, too, who did not do their work in a satisfactory manner; and they thought that, because they belonged to the Union, it would keep them in their places, and this caused a lot of trouble.

What steps did you take to put an end to the trouble?—There was one case in 1889 in which we had to discharge a man for not performing his work in a proper way; in fact, he used to charge the retort with the wrong amount of coal. He tried to recover his wages. But the Judge decided that, as he had refused to obey the order of his superior, the Company were justified in dismissing him; and he gave a verdict for the Company, and with the costs of Counsel, which came to five guineas.

What was the order which he did not obey?—To put the amount of coal into the retort with which it had been previously charged, and which had been carbonized in it for years. I may say that this very man managed to get into one of our works some time afterwards under another name, and caused a great deal of trouble.

Is he now in your employ?—I do not think he is at present. The rest have since been doing better.

Have you introduced any improved machinery since 1889?—Yes; we have introduced machinery for the purpose of drawing and charging the retorts, and that is working satisfactorily.

Did the men take kindly to it?—At the time, they did not. We had to put the machinery into the hands of the firm who erected it. They provided men to work it; and after this had been done satisfactorily, they handed it over to us. When we first introduced the machinery, we had a great deal of trouble. The men who were employed on it were assaulted. The consequence was we had to keep men on the premises, and to house and feed them; and in order to protect them, we had a body of police.

About how many men were employed?—61.

And you had to protect those men against their fellow-workmen?—Yes. On one occasion, when two of the men were leaving work, they were in the train ready to go off; and some of the old hands came up and dragged them out of the carriage, and threw them on to the platform, and they were left behind. A telegram was sent to me in London; and I immediately went to the police station to get protection for the men. But I found that the only way was to keep them on the works; and I had a body of 34 policemen there as well. This went on for about seven weeks.

Was the cause of this strike the introduction of improved machinery, and nothing else?—We believe so.

And these men were assaulted simply because they worked at improved machinery?—So far as we can ascertain.

What is the tendency of the machinery? Does it lighten and diminish the amount of labour?—Yes; and the men instead of having to go close to the retort to draw it, have simply to operate the machine, which makes their task easier. The machines are working well now; and we have extended them. We are waiting now to see the result of inclined retorts, with which we have been experimenting. There is continuous improvement in machinery for the manufacture of gas, which renders the work less arduous and less dangerous.

Have you had any trouble with the Gas Workers' Union since 1889?—Yes; we have had trouble from time to time. The Union is not like the old one of which we had experience—the Engineers and Boiler Makers' Union; we had no trouble with them. But this particular Union seem to devote their efforts to forcing everybody to belong to it, whether he likes or not. At the very commencement of it, we had a cessation of work simply because there was a man in a retort-house who did not belong to the Union; and the other men, although we had a monthly agreement with them, threw down their tools, and insisted on his being removed. We thought it better to temporize with them until we were thoroughly prepared; but it is a most serious thing that the lighting of London should be jeopardized in this way. The old Unions were well and courteously conducted by the leaders; and we did not object to them. But the Gas Workers' Union have always been, what they call themselves, "a fighting body."

You think they have been capricious, and rather tyrannical?—Yes.

Do matters go more smoothly now?—I think they have lost a number of their members.

Did you hear Mr Thorne's evidence?—No; but I read it afterwards.

Mr. Thorne himself has "learnt a lesson," I think he said?—Yes.

I believe you complain that the Union called a meeting in the works against a non-Union man do you not?—Yes. We had a great objection to that; and I told them that the Company were perfectly neutral, and did not inquire whether a man belonged to the Union or not, and that, if any meeting was to be held, it must be outside the premises of the Company.

Has not the monthly agreement been carried out faithfully—or have any of the men thrown up their work and gone off at a moment's notice?—I think there have been one or two cases, but nothing of any importance.

The Union has not attempted to break through that regulation have they?—No; although we have had rumours that they might do so; and it might be necessary to provide against that.

Is there anything more you would like to say with reference to the Gas Workers' Union?—At one period, in 1890, they were holding meetings in different places, and trying to force everybody to join the Union; and we had some notion that they might strike without any notice whatever, because they struck once, on Dec. 27, 1872, without the slightest notice. We employed 500 stokers at that time. There had been a secret meeting of the Union the night before; and the delegates told the men not to go to work. Though I expostulated with them, and told them what they were liable to, they said there was a dispute at the works of another Company; and, until that was settled, they had instructions that the men employed at Beckton were not to go to work, and 400 men went out of the works. Having that experience before us, we thought we ought to be prepared; so in 1890

we had buildings put up at all our stations, at a cost of more than £20,000, and made every provision, so that, in case of a similar state of things occurring, we should be able to house the men, and keep them all on the premises, and protect them.

In 1872, the state of the law was not as clear as it is now. Did you take any proceedings against those men?—We prosecuted six of them for conspiracy; and they were sentenced to twelve months' imprisonment, which was reduced to four months. We took out 500 summonses, and went on with fifty; and those fifty men were sent to prison for terms ranging from a fortnight to six weeks. But we have been told that, though men know they are liable to three months' imprisonment, they will run the risk of it. Practically, they have never done so; but we felt we ought to be prepared for every emergency.

So far as the Gas Workers' Union are concerned generally, are they displaying more moderation and giving you less trouble?—Yes. I am simply speaking now of the state of things as it existed in 1890.

I believe you have something to tell us about the coal porters?—Yes; in December, 1889, there was a meeting held at the Mansion House, at the instigation of the Coal Porters' Union; and we were told that, unless 4d. per ton was given for the unloading of coal, the whole of the coal discharging would be stopped the next morning. We had already made arrangements for the men who discharged our ships to pay them 4d. a ton. But it is a totally different thing discharging coal-barges, where, in some cases, the men are satisfied with 2d. a ton; and it pays them very well, as they earned 7s. 6d. a day. The very fact of raising the price by 2d. per ton was to send the wages up to 15s., which we considered most extravagant pay for that class of work. However, we agreed to pay rather than have our works stopped; and we have paid it from that time to this. But not knowing the extent to which the rise might go, we turned our attention to labour-saving appliances; and the result has been that the work for which we paid those men who insisted upon it 4d. a ton, we now get done for $\frac{6}{10}$d.—2d. a ton would cover it all. Practically, therefore, we are unloading at a much lower rate than before our attention was fortunately drawn to labour-saving appliances; and if it had not been for this demand on the part of the men, I do not think we should have been so eager.

Do you provide cottages for your workmen to any extent?—Not to any very large extent; in fact, we find that the men prefer to live as near to London as possible. Our Beckton works are about two miles away from the outskirts of London; and we provide for workmen's trains to take them backwards and forwards to the Beckton works. We have about 118 cottages there for the foremen and the principal men who require to be on the premises. The workmen are all within a radius of three or four miles round the works—at Barking (from which place they can walk across the fields in 20 minutes), Canning Town, East Ham, and Woolwich.

The men are eight hours a day inside the works; and it takes them on an average an hour a day to go backwards and forwards?—Half-an-hour each way.

Compared with other occupations you consider that this is a well-paid one?—Yes; we have no difficulty in getting men to do the work, especially in winter time. The supply is rather in excess of the demand.

How much a week does it cost these men to go by train?—I think they pay 2d. a day—1s. a week. A good many of them walk.

You have practically no competition in your district?—Just so. We have what is called a regulated monopoly under statute.

And your dividends descend as your price ascends?—Yes.

What is your average dividend now?—Twelve per cent. That is a good dividend for those who bought their shares originally. But a considerable portion of the capital has been raised under what are called the auction clauses; and I do not think the holders realize more than 5 per cent. I myself have paid £260 for shares; and they are now down to £210.

How is it that they have fallen so much?—Because the dividend has fallen. The cost of manufacture has increased; and the profit earned has not been so great.

You do not attribute this entirely to the increase in the price of labour?—Not entirely; of course, the increase in the cost of coal has had a great deal to do with it.

At the price of the day (£210), what do the shares pay?—You can buy shares to pay a little under 6 per cent. At £200, of course they pay exactly 6 per cent.

Have you any suggestions to make to the Commission for improvement in the state of the law as to the relations between masters and workmen?—I think that a gas company is in a different position from any other trading concern. We have the responsibility for keeping our district lighted; and I consider it ought to be put out of the power of any Union, or any body of men, to try and enforce their terms, and say, "If you do not do so and so, we shall all leave our work."

But they cannot leave their work in your case without giving a months' notice?—No, not legally; but you heard what Mr. Thorne had to say as to the men quitting their work without notice.

But if they do leave without a month's notice, they are liable to three months' imprisonment, with or without hard labour. Do you want the law to be more severe than this?—No; but their idea is that, if a body of men make up their minds at one time to leave their employment, the law is powerless to prevent them.

Do you mean to tell me that the law is not strong enough to punish evil-doers in England?—That is the idea.

If the law is not properly administered, what more can you have. The law, you say, is severe enough, and it gives you ample protection; therefore you have no case that you can adduce to the Commission except failure of administration?—Except that the men have ignored their agreement, and put down their tools.

In the last ten years?—Yes. Within the last two years we had a case at our King's Cross station where they stopped work for the whole of one shift, because there was a non-Union man employed. We told them, if they persisted in that, summonses would be taken out against them; and then they went on again to the next shift.

You did not prosecute?—We did not.

You overlooked that breach of contract, and did not bring it under the cognizance of the law?—No.

You cannot complain of the law then, if you have never appealed to it?—I suppose we cannot.

It is not an unusual case to overlook a petty breach of that kind in the interests of peace and quiet is it?—It is not.

You never discharge a man, I suppose, in any circumstances without giving him a month's notice?—Except where a man absolutely refuses to obey reasonable instructions.

Has it ever occurred to you whether it was possible to establish a Board of Conciliation and Arbitration in connection with the gas-works in London?—I think such a thing would be very desirable in case the representatives of the Company and the representatives of the men were not able to come to terms.

Is it not well to have such an institution working before your difficulties arise, so as to prevent them?—I think so.

And you think, so far as your Directors are concerned, they would have no objection to that?—I cannot speak for my Directors; but, for myself, I am quite prepared to advocate it. In 1889, we were prepared to lay our case before the Committee of the Mansion House; but the men would not bring theirs.

But that was not exactly a typical case?—Things were not quite as quiet then as they are now.

Furthermore, it was not a time at which a Board of Arbitration was in existence. It was simply a case in which they were attempting to mediate between the employers and the employed?—There was no organized Board of Arbitration.

Mr. *George Livesey*, Chairman of the South Metropolitan Gas Company, was then examined. Replying to the CHAIRMAN, he said the Company employed 2940 men in the summer of last year, at wages amounting to £4770, or £1 12s. per man, per week; and in the winter, they employed 3641 men, at wages amounting to £6424, or £1 15s. 3d. per man, per week. These amounts included piecework, and a small quantity of overtime—£125 2s. and £143 18s. 11d. respectively. It was mainly the stokers' piecework and unloading coals that ran up the average.

The CHAIRMAN: In what capacity are they engaged?

Witness: Besides many minor occupations, there are three principal classes of workmen—(1) Yard labourers; (2) fitters and mechanics or artisans; and (3) stokers and retort-house men.

What are the hours of labour?—For yard labourers and mechanics they were: 59½ per week prior to 1860; 58½ per week prior to 1862; and 56½ per week from 1862, when the Saturday half-holiday commenced. They were reduced to 54 hours per week in 1889. Prior to 1889, the men were always paid for 60 hours; but in that year the half-holiday ceased to be a gift, the unit for calculating wages was altered from a day to an hour, and the weekly amount was increased.

What about the stokers?—Their work is continuous day and night. Prior to 1889, they worked on the two-shift system, being on duty about eleven hours; but actually they were at work about half the time.

Is that system still in force?—In 1887 and again in 1888, following the example of Liverpool, where about forty years ago the three-shift system had been introduced by the Engineer (the late Mr. King), also Bristol, Southampton, and other places, I suggested it to the South Metropolitan men, but there was no response. However, in 1889, the stokers formed a Union; and, being captured by the Socialists, they demanded the eight-hour shift, which, having been already offered, was immediately granted at a slight increase of pay.

Are you now working on that system?—At two of our six stations, yes; at the rest, no.

How is that?—Immediately after the strike, the choice was left to the men; and at three stations they elected to go back to the two shifts—of course, at a corresponding increase of pay—and another station went back last year.

Can you give the rates of wages, say during the last fifty years?—Yes; I have examined the wages-books since 1850, and have otherwise been able to go back to 1838. The results are set out in the table I will put in.

Speaking generally, what has been the increase in wages in the fifty years?—About 60 per cent. In some cases more; but in none less, than 50 per cent.

Do you know anything about house accommodation and rent?—Yes; it has increased from 80 to 100 per cent.

Are there any sick or benefit funds in connection with the Company?—Yes; in 1842, a sick fund was founded. Shortly stated, for 3d. per week, 12s. for three months, and 6s. for another three months, is provided in sickness, and £12 10s. on the death of a member and £7 10s. on the death of a member's wife. The funeral benefits are mainly met by a special levy. The Company subscribe yearly such sums as shall be required to make the fund financial. They give, in fact, about 2d. to every 3d. paid by the men. Membership is compulsory. In 1855 a superannuation fund was founded; the subscription being 3d. per week. The Company contribute an equal amount. The present benefits are a pension ranging from 10s. to 18s. a week, according to the length of membership, which can be claimed at 55 years of age, if a member is incapacitated, and without any condition at 65 years of age. By one of the rules, provision is also made for men who are not incapacitated becoming annuitants at 55 years of age. Last year's balance-sheet shows that there were 62 annuitants.

How and by whom were these funds founded?—The men were called together; and the proposals laid before them by the late Mr. Thomas Livesey, who was then Secretary and Manager. A free discussion took place; and I believe the men unanimously agreed to start the funds—the Company in both cases commencing them with a special donation, and guaranteeing their starting. The men have also a widows' and orphans' fund, managed by themselves, to which the Company give an amount equal to the men's subscriptions.

Are any holidays allowed with pay?—Good Friday and Christmas Day have been holidays, with full wages paid for nearly fifty years. In 1860, the late Mr. Thomas Livesey started the week's holiday, with pay, for all regular workmen. He proposed it to the Directors on the ground that there was no reason why the clerk should be paid during his holiday and not the workman. There was, and is still, one condition attached to the gift, which is that the men shall go into the country and not loaf about the public houses in the neighbourhood. In 1872,

Rates of Wages, Hours of Work, Holidays, and Benefits of the Workmen employed at the Old Kent Road Station of the South Metropolitan Gas Company

Date.	No. 1.—Yard Labourers.			No. 2.—Fitters and Mechanics.	Hours of Work for Nos. 1 and 2.	No. 3.—Stokers.		Hours on Duty for No. 3. Number for each Shift.
	Rate per Day of 10 Hours.	Average Rate.	Proportion of Men at the Lowest Rate.	Rate per Day.	Per Day. Per Week.	Rate Per Day.	Rate Per 7 Days.	
1838	s. d. 2 6	s. d. 2 6	All	4s. 0d. and 4s. 6d.	10 59½	s. d. 3 8½	s. 26	About 11 to 11½
1840	3 0	3 0	All	4s. 6d. and 5s. 0d.	10 59½	4 0	28	Do.
1850	3 0 3 3 3 6	3 1½	74 p. ct.	s. d. 5 0 5 6 6 0	10 59½	4 0	28	Do.
1860	3 0 3 3 3 6	3 3	52 „	5 0 5 6 6 0	10 58½ and 56½ from 1862	4 3½ And in 1866 5 0	30 35	Do.
1872	3 6 3 9 4 0 4 3 4 6	4 0	23 „	5 0 5 6 6 0 6 6	10 56½ but always paid for 60 hours per week.	5/2 and 1/6 37/8 for 7 days per week. 32/6 for 6 days Sunday work from 1872 stopped in daytime.		Do.
1880	3 9 4 0 4 3 4 6	4 2	4 „ 45 „	5 6 6 0 6 6 7 0	Do. do.	Do. do.		Do.
1889	3 9 4 0 4 3 4 6 4 9	4 3	6 „ 24 „	5 6 6 0 6 6 7 0	Do. do.	Do. do.		Do.
1890	Per Hour. Per 9½ Hrs. 5½d. 4s. 2d. 5½d. 4s. 4d. 5¾d. 4s. 7d. 6¼d. 4s. 11d. 6¾d. 5s. 2d. Increase of wages in 50 years about 60 per cent.	4 7½	3 „ 32 „	Per Hour. Per 9½ Hrs. 7¼d. 5s. 11d. 8¼d. 6s. 6d. 8¾d. 6s. 11d. 9½d. 7s. 6d. About 50 per cent.	9½ 54 From 1889 wages have been calculated by the hour, and 54 hours paid for as the week's work.	*On the two-shift system:* 6/4 & 1/6 45/10 for 7 days 39/6 for 6 days *On the three-shift system:* 5/4 & 1/6 38/10 for 7 days 33/6 for 6 days About 60 per cent.		Do. 8 hours.

REMARKS.

Holidays with Full Pay for all three Classes of Workmen.—In 1838, no holidays were given. Soon after 1840, Good Friday and Christmas Day were allowed. This continued till 1860, from which year one week's holiday was granted, with full pay, to all men in constant employ. In 1872, the week's holiday was given, with double pay after three years' service; and this was continued till 1890.

Benefit Funds.—A sick fund was started in 1842. The subscription is 3d. per week; the sick benefit, 12s. per week for three months, then 6s. for three months; also £12 10s. on the death of a member, and £7 10s. for a member's wife. The Company guarantee the stability of the fund, and contribute what is necessary—about 2d. per week per member. A superannuation fund was started in 1855. The subscription is 3d. per week; the Company contributing an equal amount. The pension ranges from 10s. to 18s. per week, according to age and length of service.

double pay was granted with the week's holiday to all men who have been in the service of the Company three years. The total amount paid for holidays last year was £5847 2s. 8d.

What about Sunday work prior to 1872?—The stokers everywhere worked just the same on Sundays as on other days. Some attempt had been made to give a day off once a month; but the working on Sundays was not suspended, it being generally believed to be impracticable. About 1872, however, Dr. Gritton, the Secretary to the Lord's Day Observance Society, invited the Engineers of the London Gas Companies to meet him to discuss the question. He found many of them very favourable to the movement, with the result that gas-making was, and is still, entirely suspended from 6 a.m. to 6 p.m. on Sundays, except in cases of emergency. To the credit of the men, it must be said that they willingly surrendered the pay, in order to enjoy the day of rest. They are now paid time-and-a-half if required to work on Sundays.

Is anything else done for the men?—The Company have from time to time purchased land, some of it suitable for gardens; and this the men have been allowed to use without rent. These gardens are highly appreciated. In 1890, the Company undertook to receive the voluntary weekly or other savings of the workmen, and to pay 4 per cent. interest thereon, as an aid and incentive to thrift. This has been very successful, some of the men having already nearly £100 to their credit. When we started the profit-sharing scheme, we paid them the calculated bonuses for three years as a sort of "nest-egg."

How does it pay you to allow 4 per cent. interest on the men's savings?—We are continually requiring additional capital to meet the extension of business. Part of the capital has to be raised by the sale of ordinary stock by auction, which costs the Company 5½ per cent. The other part has to be raised by debenture stock, at a cost of about 3½ per cent. Taking the average, we find we can afford to give the workmen 4 per cent.

You give them 4 per cent.; and although you have some trouble in keeping accounts, you do not lose by it, and they profit by it?—That is so.

The Chairman: That is very satisfactory.

Witness: As to overtime, we have always found the men anxious to obtain overtime; but the practice has been discouraged, although every week some is necessary.

What proportion does it bear to the general wages?—In the weeks ending June 25 and Dec. 17 last year, it amounted to 2½ per cent. and 2¼ per cent. respectively of the total amount of wages paid. There is a considerable amount of piecework.

Has your general experience, extending over 40 years, been that you have had many or few disputes?—Until 1889, none whatever. Disputes may be said to have been unknown until the Gas Workers' Union was formed early in 1889, when they became continuous until they culminated in the great strike in December. Since then, they have again disappeared.

Was there a strike in 1872?—Yes; but it did not affect us. It was a strike of stokers at many of the gas-works in London, mostly north of the Thames. It was for an increase of wages, which was refused. The men left their work; and navvies, and others, provided by railway and other great contractors, temporarily took their place. There was no picketing, and no thought of forcibly interfering with the new men. The strike lasted only a few days. The stokers to some extent simply changed places—leaving one works and going to another; but practically they all returned to work. There was a large advance in wages, by gradual steps, from 1838 to 1889, and we have tried to give to every man the wage we thought he was worth. Many of the advances were made without being asked for; and we have always tried to make the rates of pay within the works rather better than those outside. The work of the stokers is more arduous than that of outside labourers; but that of the yardmen is not. The work in the retort-house is exhausting, because of the heat.

Does the work create great thirst?—Yes. We supply the men with oatmeal and water.

Is that the best means by which they can slake their thirst?—Yes. At one time it was thought beer was best, and they were allowed to have barrels of beer on the premises; but it was found not to be good. We disallowed it, and now supply oatmeal water instead.

And are the men better for the change?—Yes; I am sure of it. They are better in health for it. I am a little prejudiced perhaps; but I am certain it was a mistake to have beer on the premises, as the men were tempted to spend their off-time in drinking.

Were there no Unions in 1872?—Not affecting gas-works.

You do not complain of the Unions of skilled artisans?—Not at all.

Was there any increase of wages in 1872?—Yes; but not what the men asked for. In our case, we, on Nov. 1 in that year, gave 1s. 6d. a week as good time money. The men wished to have it in the form of 3d. a day; but it was successfully contended that a man who could be relied on to do regular work was worth 1s. 6d. a week more than an unsteady man. Good time money was adopted in 1889, as one of the demands of the Gas Workers' Union.

Now tell us all about 1889?—The circular of the Commission asks for a statement of the "causes, development, organization, and cost" of strikes. This will be a rather long story; but it should be given.

What was the beginning?—The stokers at Beckton, in the early part of 1889, asked for certain alterations, to enable them to have more time at home, which being refused. The Union was formed there in March, 1889; and they then began to agitate for eight-hour shifts. Between March and June, the movement extended from Beckton all over London; and in June they made a simultaneous demand for eight-hour shifts. The South Metropolitan Directors met their stokers' representatives in conference on June 19, when the demand for eight hours was granted; and on July 1, a formal notice of the alteration was given. The work was reduced greatly, but the pay remained the same, or was slightly increased. The work was diminished by about one

sixth; and this increased the cost 20 per cent. The men obtained the eight-hour shift so easily that I am afraid they felt it was a pity they had not asked for more. They soon made fresh demands for small concessions, some of which were granted. For instance, the stokers objected to do anything but draw and charge the retorts, which ultimately brought the increased cost to more than 40 per cent. I have here a comparative statement, showing that the cost of carbonizing went up from 2s. 5¾d. per ton in 1888 to 3s. 7d. in 1889, or 44 per cent. advance. This was a great surprise to the Company, because, having conceded the eight-hour shift, they certainly expected the men would keep their promises, and work well; whereas, in fact, they so managed it that we had to put on more men to do all sorts of things. In August came the dock strike; and John Burns has said repeatedly that the success of the stokers was the cause of the dock strike. At any rate, at that time the coal porters left their work without notice. They had made no request whatever for an increase of pay, but stopped work in sympathy with the dockers. After being idle for some time, they said they would not resume work unless their pay was increased from 3½d. to 4d. per ton. These men were in our regular employ at East Greenwich. When they were not unloading ships, they were engaged in the yard. Early in September, 1889, a very trifling question arose, which I mention, from an historical point of view, because it originated the phrase about "smashing the Union." One day I was in the retort-house, and the stokers refused to oil the hinges of the retort-doors as usual. They said they had no objection to doing it, as it did not occupy five minutes a day, but that they had been ordered by the Union not to do it. I said to them: "If your Union does that sort of thing, it will not last twelve months." It was then reported all about the place that I had said I would smash the Union. After this, it became apparent that the stokers were determined to force all the men to join the Union. They gave us notice that rule 16 was to be enforced, which provided that all men working in the retort-house should be called upon to join the Union. The intimation was given in a letter from the Secretary of the Union.

You understood that no man was to be employed on your premises who was not a member of the Union?—That is so. At Vauxhall works a report was made to the Engineer about this time that a man named Purkiss had been trying, by unfair means, to force other men into the Union. This man was discharged by the Engineer. On the morning of Monday, Sept. 16, I was telegraphed for; and, on going to the works, found all the men assembled in rather an angry mood, and a notice was handed to me demanding the reinstatement of Purkiss. I said: "Well, you ought first of all to ask me to inquire into the justice of his having been dismissed; and I promise you, if justification or proof cannot be given me that he deserved dismissal, he shall be reinstated. Will you withdraw your notice?" The men, having retired to consider the matter, said they would not withdraw the notice. On the Wednesday, I called the Old Kent Road men together, told them of the circumstances, and promised that Purkiss should be reinstated. They said: "Will you meet the delegates on Friday?" and it was arranged that the Directors should meet them at twelve o'clock; but at eleven o'clock on that day, to my great astonishment, the men at all the stations handed in their notices. I thought it was a very unfair thing. We were not prepared for a strike, and so I said Purkiss should be reinstated, and that we would pay his wages for the time he had been out. They next asked that another man who had left Vauxhall should be reinstated; and I agreed to that also. An agreement was then drawn up, which was signed by myself and the representatives of the stokers, to this effect: "The South Metropolitan Gas Company hereby agree and undertake that members of the Gas Workers' Union shall not, in consequence of such membership, and so long as they faithfully perform their duties, be interfered with by the foreman; and the representatives of the Union agree not to interfere with men who are not members of the Union." At the time the men made this bargain, they said: "Although we will not intimidate or interfere with non-Union men, you must not ask us to work in the same gangs with them, because you know it will be impossible for Union and non-Union men to work in the same gang." I knew what was meant, because, in working retort-scoops, it would be awkward for any man who was not in harmony with those with whom he must co-operate, who could easily injure him. I therefore assented to that.

Then an agreement was entered into by both parties and carried out?—Yes, for a few weeks; but the Union men succeeded within a month in bringing all the men into the Union.

Did you interfere with their doing that?—We did not, because we had engaged to leave them free to do as they pleased. What had taken place, however, was sufficient to convince us that a strike was likely to take place at any moment without warning; and the Company therefore began at once to make preparations to meet it. We had frequent conferences with the Engineers of the various stations to discuss matters, and proceeded with arrangements for housing and feeding men on the works. We took steps to obtain police protection, arranged about advertising for new men, provided for protecting the vulnerable parts of the works, and decided upon efforts to retain the loyalty of such men as were not in the Union. All this was done quietly and secretly; because, while we wished to be prepared for any emergency, we were most anxious to avoid irritating the men.

What was the Union doing?—There was a strike at Bristol in October, creating discontent; and it was an open secret that another 1s. a day would be demanded in December. At the end of October, a printed notice was given by the Union for double pay on Sundays from 6 a.m. to 10 p.m., to take effect on Sunday, Nov. 10.

Did you yield that point?—I asked the delegates of the Union to meet me and the Engineers at our office, and they did so. I asked them why they made the demand; and they said it was to stop Sunday labour. I reminded them that we had not worked on Sundays at all, and that they had agreed, so lately as June, that Sunday labour should be paid for at time-and-a-half from 6 to 6. I told them I considered it unfair of them to so soon depart from the agreement. They said that that was not intended to last for ever. I asked what further demands would be made. Thorne, the Secretary of the Union, said that he thought it would have been better to wait until the half-yearly accounts were out in February, showing how the Company stood, before making the demand; but the others told him he could only speak for himself, not for them. I conceded the double time under protest, but told them I should take it back as soon as I could.

What was the attitude of the men towards the Managers and foremen?—Anything but friendly; indeed, the control of the work had completely passed out of our hands.

Was there any real ground for anticipating trouble?—Yes; we were continually receiving information which convinced us of that. I went to the police because I thought it only fair we should inform them of what might happen. I pointed out to Mr. Monro, the Commissioner, that there was a difference between our case and that of the docks, inasmuch as the stoppage of the gas supply would be a public disaster. He said: "Everything the police can do within the law will be done." Then, as another and last means to prevent the possibility of a strike, the thought occurred to me that it would be far better, instead of fighting the men, to conciliate them. I have here in my hand the original rough draft of the profit-sharing scheme as introduced to the Board at the end of October. I suggested that the money had better be spent in this way than on a strike; and that, by means of a sliding scale, we should let the men share with the public the benefits of the reduction in the price of gas. The Board adopted the proposals. I then called a meeting of representatives of all classes of our employees at Old Kent Road, and explained to them the profit-sharing scheme. The representatives of the non-Unionist men at once said it was the finest thing they had ever heard proposed. The delegates of the Gas Workers' Union agreed that it seemed a good thing, but said they could not pronounce upon it until they had consulted the Executive. The same afternoon I met a number of the representative men at the Vauxhall works. But they did not appear to appreciate or understand the scheme, and the same was the case at two of the other works; and we thought therefore it would have to be dropped. In the course of the week, however, some of the free men asked themselves why they should lose such a good thing merely because the stokers would not go in for it. Therefore it was resolved by the Directors—unanimity among the men not being a necessary condition—to offer the scheme to any man who chose, by signing the agreement, to accept it. The following notice was then issued to the workmen:—

In order to give to every regular workman employed by the Company a direct interest in its prosperity, the Directors are prepared to place to the credit of every such workman who will sign the form of agreement herewith annexed, a sum of money annually as a bonus or percentage on his wages, regulated by the price charged for gas on the principle of the sliding scale, so that the workmen as well as the shareholders shall be benefited by reduction of price.

The shareholders get ¼ per cent. additional dividend for each reduction of 1d. per 1000 feet.

The workmen's scale will be 1 per cent. on their year's wages for every 1d. reduction below 2s. 8d. per 1000 feet.

The annual profit-sharing will be limited to those men who serve under agreement, and will be calculated on the 30th of June each year, when the amount will be credited to each man's account, who may withdraw it on giving seven days' notice, or it may be left to accumulate at 4 per cent. compound interest. The money so left shall remain the absolute property of the man in whose name it stands, and at his disposal so long as he remains in the service of the Company, or is placed on the superannuation list, in accordance with the rules and regulations settled by the Committee appointed for that purpose, and set out in full in the employees' pass-books.

This offer is made as a recognition of faithful service in the past, and as an inducement to the same in the future.

The proposals in regard to the regular men were also to apply, in a modified form, to the winter men. In order to give the men a substantial benefit immediately, it was agreed to calculate bonuses for three years' back, and place the same to the men's credit as a "nest-egg." None of this nest-egg money, except in case of death, was to be withdrawn in the first year, nor in the first five years, except in case of death, superannuation, or termination of service with the Company. Any man who struck would forfeit his bonus. One of our objects was, so to speak, to protect the men against themselves, and to help them to save money. The original rule was that, at the end of five years, any man might withdraw half his accumulated money on giving three months' notice, or the whole of it on giving six months' notice. We were afraid that, but for some such rule, the bonus would be drawn at once, and so do the men little good. I do not approve of this restriction now; but at that time our scheme was crude, and capable of improvement. During the specified period of five years, any man who was party to a strike, whatever the provocation might be, was to forfeit his right to share in the bonus.

Then you practically placed him at your mercy as far as that was concerned?—Yes.

Supposing you reduced his wages?—There was a clause in the agreement that the Company should make no alteration in the wages to the disadvantage of the men.

Do not you think five years is a long time to bind men to your will?—Yes; but that has been altered now, although all the non-Unionists accepted it at the time, and within a fortnight about 1000 men had signed. These men were invited to select 10 per cent. of their number to meet the Directors in conference on the subject. Certain parts of the agreement, including the strike clause, to which the stokers had objected, were eliminated; and we agreed to let the men draw their bonus every year. They generally accepted the concessions; and it was one of the most satisfactory meetings of working men I had ever attended. On the last occasion when the agreement was under discussion before the Commission, a good deal of objection was made to it by the witnesses; and it was said that it placed the men in the absolute power of the Engineer—that, if we had good men whom we did not want to lose, the Engineer might refuse to let them go. It was suggested to me privately that it might be desirable to drop the agreement altogether. But last Wednesday I asked the representatives of the workmen to meet me for the purpose of ascertaining their opinions; and I found they were strongly in favour of it—in fact, the one anxiety of every man who comes into the works is to sign the agreement; and as their agreements expire, the men are very careful to come and sign their renewals. There has not been a single case of a man wanting to leave being refused permission.

I produce a letter to that effect sent to me voluntarily by a man who left us to go to a better situation at Sheffield, and who testifies to having received every kindness and assistance at the hands of our foreman and the Engineer. The following is the form of agreement :—

MEMORANDUM OF AGREEMENT made the day of 189 between for and on behalf of the South Metropolitan Gas Company, of No. 709A, Old Kent Road, in the County of Surrey, of the one part, and of the other part.

1. The said for South Metropolitan Gas Company agrees to employ the said , who says that he is not a member of the Gas Workers' Union, for a period of months from the day of the date hereof at one or other of the stations of the said Company, if he shall remain sober, honest, industrious, and able to do the work allotted to him, and shall not at any time during the said period become a member of the said Union.

2. The said agrees to serve the said Company for the said period of months in whatever capacity he may from time to time be employed by the said Company at the current rate of wages applying to such capacity.

3. The said agrees to obey the orders of the foreman in charge.

4. The hours of working for yard men to be 54 hours per week.

5. The Company undertakes that, during the continuance of this agreement, the different rates of wages in force at the date hereof, and which, under clause 2, may become payable to the said shall not be reduced.

6. The said to be entitled to the benefit and be bound by the conditions of the annexed notice, so long as he shall continue in the service of the Company under agreement.

As witness the hands of the parties,

No obstacle will be thrown in the way of any man engaged under the above contract who may wish to leave the Company's employment before the expiration of the period of service therein agreed for, provided he shall notify such wish to the Engineer of the station at which he may for the time being be employed; and, on receipt of such notice, the Engineer shall, in his discretion, consider whether the services of such man can be dispensed with without detriment to the Company, and, if so, permission will be given at the expiration of the usual week's notice.

The CHAIRMAN: Now tell us what took place when the strike began, and how it began.

Witness: Three men at Vauxhall—Harvey, Kerr, and Beadle—had signed the agreement. The Union delegates watched all the men most closely. Any men who were seen talking to the Engineer or foreman had to be very careful. The three men named, having signed the agreement, it came to the knowledge of the Union; and the Union sent a letter to me, enclosing a resolution declaring that the men at Vauxhall would be justified in striking if the three men in question were not removed. That came on the 2nd of December, when I had thought all our troubles were over. The answer I gave was that, as there was no reasonable ground for the demand, it would be refused. I had a conference about it with the Chief Engineer and the Secretary. I said: "This means a strike; and I take the responsibility by refusing the demand." We had a somewhat similar difficulty at Rotherhithe the same day. We then agreed to set to work and make our preparations openly. On Wednesday, Dec. 4, just as the Board was about meeting, there came a letter containing a resolution passed at a meeting of delegates of the Gas Workers' Union, stating that, in the opinion of the meeting, the action of the Company in forcing them to work with men who had signed the bonus scheme, and whom they looked upon as blacklegs, was unjust and unfair, and that all the men in the Company's employ would be justified in giving in their notices, unless the profit-sharing scheme was abolished, and all the men who had signed agreements removed from the works. We had been watching our opportunity; and we saw it on the receipt of that letter. We sent a copy of the letter to all the papers, and informed the public that a crisis had arrived in regard to the gas supply of South London. On the following day, an answer was sent to the Union, stating that their demand could not be conceded. On the Friday, they sent word that there had been a clerical mistake in their letter, which should have said the scheme must be dropped, "or" all the men removed from the works, instead of "and;" but that made no difference. By eleven o'clock on Thursday, Dec. 5, 2005 notices were personally handed in by the stokers.

What did the Company do?—Immediately telegraphed to advertisement contractors to insert the prepared advertisements. Clerks and inspectors and workmen were sent as agents to obtain men from all parts; the terms having been settled beforehand. Large posters were ordered to be put up all over London; and everything was done to make known the need of men to take the place of the strikers. High terms were offered.

How did the Unionists take it?—On Friday, Dec. 6, barge loads of provisions arrived at all the stations, which, with the other active preparations going on, convinced them that this time the Company were in earnest. They sent agents into the country to counteract our agents. On Saturday, Dec. 7, events showed that, unless protected, the buildings for housing the men would probably be wrecked, and watchmen were accordingly appointed. During the Sunday night 130 blankets were thrown into Deptford Creek from our Greenwich works. Monday was a very anxious day. Some of the watchmen, being Unionists, could not be relied on, though the others were perfectly loyal. The destruction of beds at Greenwich was one evidence of intended mischief. The tools of the stokers were also being destroyed or thrown into the canal and the river. The men stopped work in the morning at Rotherhithe and Old Kent Road, and again in the afternoon at all the stations, because a few new men had been introduced. These were removed, and work was resumed. Some of the men had assumed a threatening attitude, but were restrained by others. I had been in communication with the police. The Directors considered it absolutely necessary to have police protection inside the different yards and depôts of the Company, as without it they could not hold themselves responsible for any consequences that might ensue. We felt certain that, with such large numbers of men, mischief would be done; and therefore we asked Mr. Monro, the Commissioner, to send some police within the works. Mr. Monro said they would give any support outside the works; but they must be satisfied there was danger before they could go inside. However, later in the day, I had an intimation that police would be sent in to each of our stations. When they did come, they behaved splendidly. Fifty men went into each of the works, and were kept on by relays all the week. About 700 police were engaged in protecting our works during that week. The effect that the presence of the police would have on the men was at first a little doubtful. Mr. Monro stayed until midnight to see how it was taken. He thought perhaps the stokers would refuse to go to work. He told me the stokers would have had to go out, not his men; and I quite approved. However, the Unionists were awed by the police; and they gave no further trouble, except by doing everything they could, by neglect and so on, to injure the works. We informed the men that, if they withdrew their notices by Tuesday, at noon, they could remain; but that otherwise their places would be filled up. On that day, Mr. Causton, M.P., and Mr. Beaufoy, M.P., came to me as mediators. They acted very fairly and properly, and asked me if I would meet the men. I said I would, but they must come that afternoon, as the new engagements must be posted. Mr. Causton and Mr. Beaufoy tried to get the men to meet, but did not succeed in time; and, as a consequence, we had to send off our engagements. We received as many as 900 applications for work one morning. On the Wednesday morning, we had an interview with a Committee of the Union men. They were very determined; and I am sure they believed we should not succeed in doing without them. They demanded the absolute withdrawal of the profit-sharing scheme. We refused. In the afternoon of the same day, while the Board was sitting, Dr. Clifford, the Rev. Andrew Mearns, and the Rev. Hugh Price Hughes came as mediators. The last-named talked an hour-and-a-half about "the sacred right to strike," &c. At last, I rather lost my temper, and said, "It would be much better if you gentlemen would mind your business, and leave me to mind mine."

Was the Rev. Mr. Hughes referring to the bonus clause in your form of agreement?—No. No doubt the men were right in saying the scheme would prevent a strike, as the agreements would not expire simultaneously. I stated that, from our point of view, that was what we wanted. Dr. Clifford and Mr. Mearns were perfectly fair and reasonable; and Mr. Mearns told me afterwards they were not responsible for what Mr. Hughes had said.

Had any other of your men given notice?—No; but the coal porters, who unload barges, made a demand for increased pay, which led, on Dec. 12, to a threatened stoppage of the coal trade. I attended a conference convened by the Lord Mayor at the Mansion House. The Lord Mayor was in the chair a portion of the time, and then Sir John Lubbock took his place. There were present Cardinal Manning, the Revs. Andrew Mearns and Hugh Price Hughes, Michael Henry, the Secretary, and several other representatives of the Coal Porters' Union, all the principal coal merchants of London, and representatives of the three London Gas Companies. Michael Henry demanded 4d. a ton from the coal merchants, which was conceded; and he then said they wanted 4d. a ton also from the Gas Companies. Mr. Jones and I pointed out the difference in the circumstances. Sir John Lubbock suggested that the question should be submitted to arbitration. The Gas Companies agreed to that at once; but Michael Henry said he could not accept arbitration, unless the Companies gave the increased pay at once. Then Cardinal Manning, who had moved the resolution in favour of arbitration, said he quite sympathized with the men. At the earnest request of Sir John Lubbock, we consented to pay the 4d. pending arbitration. Michael Henry then said he would accept that for The Gaslight and the Commercial Companies, but refused it for the South Metropolitan, unless they took their old stokers back. Personally I was very glad of the refusal, because our men were working for 3d. per ton, with which they were satisfied. Our coal porters left us, with the stokers, without notice; and we engaged others, who do the work at the old rates, and are contented. It was at two o'clock on Dec. 12 that the first shift of stokers left the works; a large force of police being present. At ten o'clock at night, the second shift left; and at six o'clock next morning, the last shift came out.

Did all the men leave?—Out of about 2000 retort-house men of all grades, only a dozen or two stayed in the works, having found hiding places. On Dec. 13, the new men came in from all parts. Great assistance was rendered by the railway companies, and to protect the new men in their passage through the streets against the many thousands of pickets, nearly 3000 police, mounted and on foot, were engaged, who, under the command of Major Gilbert, the Chief Constable for South London, in the most admirable manner, did their work without a single broken head. By eleven o'clock, the yards were full of men, and notices were put up that no more were required. There was, in fact, such an excess that about 2000, after being supplied with a good meal, were paid off during the day.

Was the picketing done by your old workmen, or by the ordinary crowd?—By both. There were sympathizers from all parts of London, determined, if possible, to prevent the new men getting in; and there were thousands of the loafers and idlers who welcome any chance of a row.

How had the old hands been working during their last week?—As badly as they could; in fact, it was the opinion of the foreman that, if the notices to leave had extended to a fortnight, instead of a week, the work would have come almost to a standstill.

Did they leave quietly?—Yes, the police took care of that; but the last gangs at East Greenwich and Old Kent Road set fire to the lobbies when they left.

In what condition did the new men find the works?—The furnaces were neglected, the pipes choked, and the retorts crammed with coal, rendering them most difficult to draw; in fact, in such a state that I do not know to this day how they did the work.

What was the effect on the make of gas?—On Dec. 4, the day before the notices were given, the old stokers made 27,500,000 cubic feet. On the last day, when they should have made considerably more (the demand having increased), only 23,250,000 feet were produced. The first day's working of the new men only yielded 13,500,000 feet, which was very good, under the circumstances.

Did the consumers suffer?—They went short of the supply of gas they required by about one-third; but they bore the privation very cheerfully.

How did the strikers act?—The pickets planted their men at our stations; and a great many violent assaults took place. The strikers circulated all kinds of false reports about the Company, and also about the new men. They abused the people who burnt oil-lamps, and turned on the public lamps in the day time, in order to run down the stock of gas.

Did any other men give trouble?—On the day that the stokers left, the coal porters at all the riverside stations struck without other notice than Michael Henry's threat on the previous day at the Mansion House. This gave much trouble. The same afternoon Michael Henry wired to the North to the Seamen and Firemen's Union to stop the sailing of our ships.

Did the lightermen strike?—Yes, those employed by the Company's contractors; but the Company's own men did not. There was much trouble on the river.

Did any other men strike?—Yes. During two months the Seamen and Firemen's Union picketed all the Company's steamers both on the Thames and the Tyne, calling out all the crews. Many responded; and their places were easily filled by other men.

What other difficulties had you?—Well, there was the housing and feeding of about 4000 men; and the teaching of new men to do the strange work. We also had to try and gain their confidence. Another thing was that every week when they got their wages, being unaccustomed to receive such large earnings, numbers left; and the same thing happened when the £4 bonus was paid; and, as the strikers would not return, additional new men had to be obtained. Then we had to deal, of course, with the great difficulty of getting down to ordinary pay and up to ordinary work.

What was the cost of the strike?—It is impossible to say exactly. The direct expenses were £62,328 charged in the two half-yearly accounts. To this must be added: Losses on coal and coke, about £7000; loss from less gas being made and sold, about £13,000; extra wages paid to new men, about £12,000; additional wages to new men in spring and summer, £5000. The total cost and losses were, in fact, about £100,000.

Was the result worth the cost and trouble?—Unquestionably. It checked from that day to this, for all the gas undertakings in the kingdom, the further aggressions of the Gas Workers' Union, one of which would have been the additional 1s. a day, or another 20 per cent. on wages, equal in our case alone to some £20,000 a year. But this was the smallest part of the gain—it broke down a system of tyranny over employers and employed that had become intolerable. But even that is not the greatest advantage—it gave in place of hostility and antagonism, peace and goodwill; in place of doubt and mistrust, confidence; and in place of sullen and discontented workmen, a body of cheerful, willing, and capable workers, with whom it is a pleasure to be associated. These last-named mutual advantages are worth all the cost and trouble the strike caused the Company, and all the inconvenience it caused the loyal men.

How were the costs met?—£30,000 was taken from the insurance fund, £30,000 from the dividend, and the balance from the reserve fund.

Did you raise the price of gas?—No. The consumers had most cheerfully borne their share of the burden, by going short of gas at the time of the year when they wanted it most. We, therefore, informed them by circular that they would not be called upon to pay any part of the cost.

Did you take back any of the strikers?—Very few after the agreement of Feb. 4 was signed. Less gas was required; and by that time all the worthless and useless men who came on at the strike had been weeded out. Consequently, there were very few vacancies; but such as there were were filled with the old stokers. No objection was made to them on the ground that they were members of the Gas Workers' Union. But, in consequence of a speech made by Mr. Thorne, the Secretary of the Union, at Plymouth, after the agreement had been signed, it was felt that the supply of gas to London must not be subject to the caprice of the irresponsible leaders of any Trades' Union; and therefore notice was put up at all the stations, which is still in force, to the effect that we would not employ Union men. It applies also to the Coal Porters' Union, which had twice stopped all work without notice. The men, however, had had quite enough of the Union, and were very willing to leave it; and at some stations the new men had been so badly treated by the strikers, that they strongly objected to the re-engagement of any of them.

Was there any black-listing?—Never. On the contrary, all the managers did what they could to assist the strikers to obtain work elsewhere.

You employ a considerable number of artisans; are they members of Trades Unions?—We employ between 200 and 300. We never ask the question when engaging them; but it has been found, as a rule, that, when they feel their situation safe, if they have been Unionists, they do not remain so. My experience as to conciliation and arbitration has been limited, and, so far, very unfavourable. The attempts at conciliation with the Gas Workers' and Coal Porters' Union prior to the strike were conspicuous failures.

Have you any remedy for the industrial war that now wages between capital and labour?—Yes; industrial co-operation between capital and labour; and, as an important step in that direction, and in many cases under present circumstances the only practicable step, is profit-sharing.

Why do you say that?—Because the wage-hire system has failed to produce industrial peace. In the words of our respected colleague Mr. Burt: "We have passed from slavery to serfdom, and from that to the wage-hire system, and we shall get beyond that some day."

What led your Company to adopt the principle of profit-sharing?—The immediate cause was the necessity to do something to retain, or to obtain, the allegiance of the workmen, which was fast passing away, in the autumn of 1889, under the influence of the Gas Workers' Union. The idea was not a new one. I had brought it before the Directors as the complement of the sliding-scale shortly after 1875. It was revived in 1886 in a somewhat crude form, when an annual bonus, dependent on profits, was given to all the officers and foremen. But it was not until 1889 that profit-sharing was extended to the workmen under the circumstances already mentioned, beginning with the "nest-egg." None of the men now object to sign the agreement; quite the contrary. The scheme is working most satisfactorily.

What have been the percentages on wages which the men have received?—The starting point is when the price of gas is 2s. 8d. per 1000 cubic feet, at which price there is no bonus. The bonuses have been as follows, following successive reductions in the price of gas: June, 1887, 2 per cent.; June, 1888, 3 per cent.; and June, 1889, 4 per cent.—making a "nest-egg" of 9 per cent., to be left at 4 per cent. compound interest by the decision of the men, for five years. Then the bonus to June, 1890, was 5 per cent., to June, 1891, 5 per cent.; and to June, 1892, it will be 3 per cent. The Company have been unfortunately compelled to raise the price of gas to 2s. 6d. from Michaelmas last, which has the effect of reducing the shareholders' dividend and the bonus of all the employees from the highest to the lowest.

How do they take the reduction?—Very well indeed; they appear to understand that, if they share profits, they must share losses. They inquired how it was coke was sold so cheap while coal remained dear, and were satisfied the best was being done. They are certainly working as cheerfully and as well as ever, and some are beginning to make suggestions for improvement in working.

Have you anything to say about picketing?—Nothing against fair and legitimate picketing; that is, for giving information that a strike is in progress for the purpose of persuading other men not to go to work. But in my experience, if this were its only object and use, it would be very little practised. So far as I have seen, picketing is pursued for the purpose of intimidation, and is always accompanied by violence, unless restrained by the presence of a sufficient force of police. Unquestionably the thousands of pickets congregated on the day when our new men were brought in intended forcibly to prevent their entrance to the works, as this same Union did at Bristol the previous October, and as they did at Leeds the following July.

What about labour-saving machinery?—As long ago as 1860 machinery for drawing and charging retorts has been under the notice of gas makers; and since then, from time to time, new machines have been invented. But the trouble and expense attending its introduction have so stood in its way, that very little was done. Hand labour was satisfactory; and there was a dislike to making a change. From the formation of the Gas Workers' Union in 1889, however, all has been changed. Everywhere machinery is being adopted, and to such an extent that the makers are overwhelmed with orders. In fact, machinery has now been made to answer.

What is its effect?—In one of our retort-houses at East Greenwich, it requires 14 men to work the machine in place of 36 for hand work—a reduction of 61 per cent. in the number of men. At my first interview with the Unionists, I told them it would come to this.

Is machinery being applied in other ways?—Yes. Conveyers for coal and coke are being adopted, whereby large numbers of men are being displaced. At the Old Kent Road works 120 men now do the work of 170. Personally, I am very sorry it is so; but it cannot be helped. The continued success of gas companies depends upon selling gas at the lowest possible price; and the increased cost, caused by the great rise in wages, must be met.

Is the introduction of machinery troublesome and expensive?—Both; but neither will prevent its adoption. The Union has given the necessary impetus, and inspired the management with a determination to make it succeed; and it will succeed most certainly.

In regard to the profit-sharing, if you gave your men the bonus every week, would it not work as well?—No; the effect would be quite different. I believe our present system would answer even if we had no statutory monopoly, and had to compete with employers who did not adopt the same system. We can tell that by the accounts of other gas companies. We find that it costs them in retort-house wages about ·5d. per ton of coal more than it does us for making gas, although we pay quite as high wages as they. But this is exclusive of the profit-sharing, which amounts to about 1½d. per ton. We are getting better results than we ever had before. Whether or not it is the consequence of the profit-sharing system, it is the fact.

You heard Mr. Thorne object to your profit-sharing scheme, on the ground that the men are bound for twelve months, and that it is absolutely within your discretion whether or not a man shall leave your service?—Yes; but the men are pleased with the agreement. They like to be assured of twelve months' certain work, especially when they know that in practice they can get away at a week's notice if they want to.

Mr. *C. C. Carpenter*, Engineer of the Vauxhall station of the South Metropolitan Company, stated, in answer to the CHAIRMAN, that the profit-sharing scheme, in his opinion, was working wonderfully well. The workmen showed a greater desire to economize; they took a more intelligent interest in their occupation.

Mr. *Livesey*, in further examination, said the Gas Workers' Union was started in March, 1889; and it was practically speaking founded by the Socialists.

You have spoken somewhat strongly about the New Unionists. Are you quite sure that the action of the Union was wholly unprovoked? Was there no cause for forming the Union? Why did the men join?—The men told me there was no cause as regards our Company, but that, in the case of some other companies, there was some reason for it.

Nevertheless, your men did join the Union?—Yes.

And became rather strong and violent members of it?—Yes, and are very sorry now that they ever did.

By Mr. TUNSTALL: I believe the workmen of this country have the sense to see the advantages of co-operation with their employers, and are willing to adopt it when it is properly put before them.

By Mr. AUSTIN: Although our rule is not to employ Union men, I do not think we should interfere with a Unionist so long as he kept quiet. I daresay we have one or two Unionists now. Although a man must declare himself a non-Unionist to participate in the profit-

sharing, he does not have to make such a declaration to obtain employment. I would have no objection to employ members of the Union if the Union was conducted with a little more moderation. We have never had any case under the Employers' Liability Act. If a man is injured in our employ, we consider it is our place to provide for him and his family.

By Mr. TAIT: I have considered the question of the men not only sharing the profits, but having a voice in the management of the business, by sending a representative to the Board of Directors; but, although it would not much alarm me, I cannot yet see that it is practicable.

Mr. TAIT: Now that you are in peaceful relations with your men, do not you think it would be well to introduce better counsels into the Gas Workers and Coal Porters' Unions by allowing your workmen to join?

Witness: I have no faith in that in regard to those two Unions, which are doing, and have been doing, everything in their power to shake the confidence of our men in the justice of our arrangements. I regard those two Unions as the organizations of the Socialists. I have nothing to do with the present leaders of those Unions, or their principles. If you (Mr. Tait) or Mr. Trow, were at the head, I would have no objection.

Mr. TROW: You do not object to Unions on reasonable lines?

Witness: Certainly not.

You do not object to conciliation on reasonable lines?—No; I want justice between the parties. If you can get it by conciliation, do so by all means.

Your idea of conciliation and arbitration is that matters should be reasoned out?—Yes.

You think your men are beginning to see that they are working for themselves?—Yes; and they are satisfied, and have authorized me to tell this Commission so.

In answer to the DUKE OF DEVONSHIRE, witness said he thought the profit-sharing system could be applied to other industries, as it had been in certain cases; and the men could be satisfied as to the correctness of the profit return by employing independent accountants.

The CHAIRMAN thanked Mr. Livesey for his evidence, and the Commission adjourned.

Wednesday, May 31.

Mr. *Livesey* was this morning recalled, and said he had omitted in his previous evidence to state what was rather important with regard to the rents of workmen's cottages. In 1850, a field adjoining the gas-works was covered with workmen's cottages, each of which contained four good rooms and a kitchen. The rent of these was then 5s. a week. They were now let at from 9s. 6d. to 10s., and were divided into two tenements—the top floor for one family, and the bottom for another. The rents had been increased, and the accommodation diminished by about one-half. These cottages belonged to private owners.

The CHAIRMAN: You believe that, in the period you have named, the rents in the neighbourhood of the great works in London have doubled?

Witness: They have certainly increased from 80 to 100 per cent. The rents of a slightly better class have not increased so much. For instance, for the first house I occupied in 1859, I paid £31 10s. a year, and it is now let at £32.

This concluded the evidence relating to the gas industry.

THE METROPOLITAN WATER SUPPLY COMMISSION.

Tuesday, May 31.

(*Lord* BALFOUR OF BURLEIGH, *Chairman; Sir* G. B. BRUCE, *Sir* A. GEIKIE, F.R.S., *Professor* DEWAR, F.R.S., *Mr.* G. H. HILL, M.Inst.C.E., *Mr.* J. MANSERGH, M.Inst.C.E., *and Dr.* W. OGLE, *Commissioners.*)

Continuing the evidence to-day on behalf of the Chelsea Water Works Company,

Mr. *Albert A. Gill*, District Engineer of the Company for about 9 years, said he was responsible for the distribution of the Company's water. The statement that the number of houses supplied by the Company on Dec. 31, 1891, was 36,250, required an explanation. Sir William Wyatt was under a slight misapprehension. The number of houses given included empty ones—rather less than 600 probably. But that would be compensated to a certain extent by the fact that all new houses were withheld from their monthly returns for six months after the water was laid on. This practice was in order that they might have something to stand against the empty houses—to make the number of supplies returned more like the actual number of supplies provided. The number of empties was a fluctuating figure; and the Company had not the means, except once in every half year, of checking the number. To get at a percentage or a formula applicable to the circumstances, he had made tests on three or four estates in the Company's district; and he found in the estate which contained the greatest number of empty houses that they did not come up to 5 per cent. Referring next to the estimate of 35 gallons per head per day for the whole district for the future extensions, he said he thought he should be able to show that this estimate was a very liberal one—not to say excessive. He had taken five typical estates, fairly representing the class of property that might be built. The first estate contained 383 occupied houses, of an average rental of £26, with two water-closets in each house; and the average supply per head per day worked out to 16·7 gallons. The next estate contained 664 houses, of an average rent of £28; and the average supply per head was 16·1 gallons. The next, a very similar estate as to rental, had 438 houses; and the average supply per head was 15·9 gallons. The next had a somewhat better class of property; the average rent being £34. It had 416 houses; and the average supply per head was 17·7 gallons. The next estate was considerably superior; the rents ranging from £40 to £42. Here the average supply per head was 19·5 gallons. Speaking of the constant water supply, witness remarked that there was very little demand for it in the Company's district, and little appreciation of it.

The CHAIRMAN: I am in your district, and I appreciate it very much indeed.

Witness pointed out that in some large buildings—such as industrial dwellings—where the Company afforded a constant supply, the consumers themselves in a great many cases made the supply intermittent. Being interested in saving water being supplied by meter, they turned it on only a certain number of hours a day. Directing attention to the value of waste inspection, witness next pointed out that, after three waste inspectors were appointed in 1874, their efforts took effect in a few years; and when after he came into the Company's service at the end of 1883, and found there had been a relaxation of these efforts, he started them again, the supply from a maximum in 1885 of 305·4 gallons per house decreased. The next year it was 294 gallons; the next, 293; the next, 289·9; the next, 266 (when there was a wet summer); the next, 270; and now it was 278·9 gallons.

Mr. *G. H. Gill*, the Secretary to the Company, was next called; and giving attention to his Company's estimate for the future, he observed that they calculated upon supplying, 40 or 50 years hence, about 10,000 more houses than now. He found that in the year 1866 they were supplying 10,000 fewer houses than at present, and that the average daily quantity of water supplied since that year had only increased by 1,489,000 gallons; while in their statement they had allowed for the 10,000 houses which they might possibly be called upon to supply in the future no less than 3,250,000 gallons. As to the question whether the water which they proposed taking at Moulsey came within their quantity allowed of 20,000,000 gallons a day, he pointed out that the Company's Act of 1875, under which they constructed the works at Moulsey, gave them power to take water from any springs on or near the works by the Act authorized, provided the quantity taken from the Thames did not exceed 20,000,000 gallons a day.

The CHAIRMAN: Then arises the question what is a spring?

Witness: Well, this water was reported on by Dr. Tidy as spring water.

The case of the Grand Junction Water-Works Company was then proceeded with.

Mr. *A. Fraser*, the Engineer to the Company, spoke as to the statement submitted on his Company's behalf. With regard to the source of supply, he remarked that it consisted of two intakes, one upon the mainland at Hampton, and the other on a small island at Sunbury. They put forward as an advantage, which they possessed in addition, a complete system of works for natural filtration of the Thames water, which had been in use for more than ten years, and by means of which the river water was passed through extensive beds of gravel and sand characteristic of the neighbourhood, before being pumped into the reservoirs from which it passed into the ordinary filter. This was totally different to the East London Company's natural filtration, as described by Mr. Bryan. Then, in addition to this natural filtration, the water so derived was filtered as carefully as water taken straight from the river. Asked if he could give any information about the amount of water the Company took direct from the stream of the river, and the amount which they took from what they called the natural filtration beds, witness explained that they only used these beds when the river was not quite at its best. Regarding the report of a threatened extension of building on a large scale at Hampton causing apprehensions of such pollution of the gravel by cesspools as would render necessary the abandonment of the practice of drawing water therefrom, he stated that all danger was averted by the construction of puddle walls between the gravel beds and the estate laid out.

The CHAIRMAN: Have you, in drawing water from the gravel, any apprehension whatever (in the existing state of matters), or any ground for believing, that the danger spoken of exists?

Witness: None at all. It is simply the river water like all the other water.

And, as such, do you count it within the limit you are authorized to take?—Yes.

Therefore, you do not put that forward in any sense as a supply in addition to that which can be obtained from the river?—Certainly not.

Concerning the suggestion that the Company were depleting the Thames, witness affirmed that there was a sufficiency of water there for the purposes of navigation and anything else, and for the Company's purposes.

The CHAIRMAN wished to know if witness suggested that the fact that the level of the water of the river at his Company's works was not altered by these operations proved that they were not depleting the river.

Witness replied that the fact went a great way in the matter of proof. He was aware that there were a lock and a weir below the works, and that the lock and weir were used for regulating the level of the water; but he still maintained that the fact mentioned showed that the Company's operations did not affect the quantity of water in the river.

The CHAIRMAN said he was sorry not to be able to agree with the witness.

In reply to Professor DEWAR, witness affirmed that there had been a steady improvement in the quality of the Company's water, and that the experiments of boring in the chalk spoken of in the statement sent in by the Company showed that, should any necessity arise for their going further afield for supplies, these would be obtainable—that there was additional water in the Thames Valley in their neighbourhood. They had, however, no intention of applying for powers to enable them to go further afield.

Questioned again by the CHAIRMAN, witness said there was no part of his Company's district so near Chertsey as to make the statement of the Rural Sanitary Authority there, concerning pollution from wasting cesspools, relative to the Company's works. These must be 10 or 12 miles away from Chertsey, and were on the other side of the river to Chertsey.

The Southwark and Vauxhall Company's case was taken next; and Mr. *J. W. Restler*, the Engineer to the Company, first gave evidence. He stated that the Company never closed their intakes. They took flood water at all times, and found no disadvantage arising from doing so as regards quality. The filters were merely clogged more rapidly, and had to be cleaned more frequently. He agreed with other witnesses

that flood water was the worst with which a water company had to deal; but at the times of it in his Company's case, their draught from the Thames was minimized because the natural collecting wells gave them half their supply. He described these wells, and also steps which the Company had taken to protect their sources against possible pollution. He likewise illustrated that, as their constant supply extended, so did the quantity of water used decrease; and he expressed his belief that, under the constant system, the supply was less than under the intermittent, where there was proper control of the fittings.

Professor DEWAR pointed out that, according to analyses, the water of the Company had been on occasions markedly turbid; and he invited an explanation of this circumstance.

Witness stated that there was no want of filtering area, although his Company were making very considerable extensions at the present time. But there was just the possibility, he added, that at times, when the river was exceptionally bad, the filtering might have to be done a little bit hurriedly; and to provide against this, his Directors had decided to provide more accommodation. He believed that the extensions of the filters would certainly reduce the chance of a recurrence of what the Professor had referred to.

On the Lambeth Company's case being taken,

Mr. *S. H. Louttit*, the Secretary and General Manager of the Company, gave evidence. He mentioned, among other things, that their parliamentary area was 102 square miles, while the area they actually supplied was 71 square miles. They had power to take water from any point within the parliamentary area—they were not limited—if they acquired land by agreement, not compulsorily. He also informed the Commission that the question of their underground water was gone into fully during an inquiry in 1880, which lasted for 42 days, and that the Assessor on that occasion came to the conclusion that that water flowed from the direction of the Bagshot sands, and was a very valuable adjunct for the supply of London. The water flowed in a north-easterly direction, and came into the gravel beds in very large quantities. He took it that these beds all around their works, and for a long distance inland, were charged with water; but whether they might be in connection with the bed of the river, he could not say. What he knew was—at least, they were so advised by their late Engineer, Mr. Taylor—that there was a very noble source of supply and a most valuable adjunct to the river supply. Mr. Taylor, he added, was enamoured of the supply from the gravel, and wished them to use it more extensively than they did; but the feeling of the Directors was that, as they had ample powers to pump from the Thames, and it was their recognized water supply, there was no use going to further expense to develop this additional supply. They would simply recognize it as a sufficient margin with which to meet any exceptional demand. Alluding to the chance of pollution from Chertsey, witness said that was very remote.

Wednesday, June 1.

The CHAIRMAN, on taking his seat this morning, stated that, in accordance with an announcement he made the previous Monday on behalf of the Commission, that they would now set apart a short time for giving an indication of what they proposed further as regarded procedure, and for hearing any suggestions that might be made upon it, they would now devote a little time to these purposes. In the first place, he would indicate in very general terms indeed, as far as they had been able to settle it, what was in the minds of the Commission on the subject of procedure. At the same time, it must be clearly understood that in anything which he said at this stage they would be hardly doing more than making a tentative suggestion. They had come to no absolute decision; and he should confine himself to indicating what they considered would be desirable. Generally, then, they thought that the inquiry divided itself into two main branches. Such matters as they had been investigating through the Water Companies would form one branch—matters such as the amount of water per head of the population which the Companies were now supplying, the sources which these had at their command to meet the supply at the present time, and the grounds upon which estimates for the future ought to be based. The other great branch of the inquiry seemed to be what more or less expert evidence had to deal with—such as the geological character of the Thames and the Lea basins. Then, speaking generally, they would like to exhaust as far as they possibly could the first branch before taking up the other. They thought that the facts in this branch so far as they could be ascertained at all ought to be more easily ascertained, and more readily available for putting before the Commission, than those in regard to what he described as the second branch; for naturally the geological formations of the Thames and the Lea basins, and other matters of that kind, opened up a very wide field of inquiry, and the evidence upon it must take longer to prepare. At the same time, as everyone who had paid attention to the evidence so far must have seen, even in the matters with which they had been dealing, there was an unusually large scope for conjecture and estimate; and whatever the conclusions they might come to, they would be a very legitimate subject of controversy, and the Commission did not expect that any conclusion of theirs would be absolutely free from debate and discussion. Under these circumstances, they felt very strongly that it was their duty to endeavour to narrow the field of illimitable discussion as much as possible; and they thought that any controversy which there was to be, as to the premisses—such as the populations supplied by the Companies, the numbers of gallons per head, the areas to be built over, and these sort of questions—ought to be before them before their report was drawn up; and that they should, as far as they possibly could, arrive at some basis of agreement which would narrow the future of the controversy, and exclude those kinds of points from it. For this purpose they had endeavoured, and they should continue to endeavour, to get information from anybody who felt he had a right to advise them on points of this sort at the earliest possible stage. And when the information was obtained, they should be prepared to take up the second branch of the inquiry. As regarded both branches (and these observations were general), they attached the very greatest importance to having distinct and full information of what everybody wished to say placed in the hands of the Commission beforehand. The Commissioners could not, unless they had this, form any opinion as to whether or not the evidence which was to be offered was going to be useful to them; and they wished to prevent anything being submitted in evidence which they did not think important. Of course, they should err on the side of taking too much evidence rather than on that of excluding anything about the usefulness of which there might be a doubt. But they were anxious not to have a single day, or a single hour, unnecessarily spent—spent in hearing evidence which should afterwards prove to have no practical bearing on the subject of the inquiry. They thought that was a paramount duty laid upon them; and, speaking from his own experience, a sufficient check was not always exercised at first in such inquiries in the matter of evidence. Then somebody thought that, because of evidence led which he considered detrimental to his interests, he must have an opportunity of contradicting it, even though, in the opinion of the executive body, the evidence-in-chief and the contradiction of it were of no practical value in dealing with the subject in hand. On this point, therefore, they made a distinct announcement, that they must ask everyone coming forward as a witness to place his evidence in their hands in advance, so as to give them the fullest information in writing or in print as to the points he wished to deal with. If now any gentleman interested desired to offer a suggestion, they would listen to it, and if necessary make a further announcement after consideration of what they should do.

Mr. JOHN HOLLAMS (Hollams, Sons, Coward, and Hawksley) observed that it was not quite voluntary on the part of the Water Companies their taking the initiative in the matter of submitting evidence. It was in response to a communication from the Commission, that they fully and fairly placed before the Commissioners the state of their affairs and undertakings; and he thought he might say they had shown that they were fulfilling, and were prepared still to fulfil, their obligations to the public. Then, as his Lordship knew, the Commission was not sought by the Water Companies. The Commission, it was no secret—it was notorious—was issued at the instigation of the London County Council. He ventured to suggest, therefore, that it was for that Council to support the kind of accusation—for he supposed there was an accusation, although they did not know——

The CHAIRMAN interposed. He said he was very anxious that the idea of any accusation should not be in the mind of anybody. They were there to conduct an independent inquiry into a matter of great public importance to the Metropolis.

Mr. HOLLAMS said he did not desire to use the word "accusation" in the sense taken by the Chairman. He simply wished to point out that the Commission had been issued at the instigation of the London County Council, and not of the Water Companies; and consequently he ventured to submit to the Commission that it would be natural, in the order of things, for the County Council to justify the necessity for the Commission, and to show what the evidence was that they proposed to bring forward—that it was not for the Water Companies to anticipate any evidence of which they knew nothing, and for which they knew no sufficient cause. In this position the Companies were fortified; because, before the Select Committee of the House of Commons in 1891, on the Metropolitan Water Supply Bill, Sir Thomas Farrer, giving sworn evidence as the representative of the London County Council, stated that he had nothing to bring forward against the Water Companies—that he wished to say distinctly—and Sir Thomas added that, in his opinion, London was well supplied with water. Consequently, the Companies did not know what charge or case they had now to meet; and he ventured to think that, having fulfilled their obligation by showing, as he supposed they had shown, the state of their respective undertakings, and that they were fulfilling their statutory obligations to the public, they ought to have fair notice of anything to be now brought forward concerning them. When he said the Companies had fulfilled all their obligations, he wished it to be understood that, if any Commissioner desired further information as to their internal affairs and resources or powers, it would be given. But his Lordship, he thought, would see that it was rather for the Companies now to become listeners, and to be supplied with some information of the kind of evidence to be submitted by those who had instigated the Commission, or asked the Commission to adopt a particular view. There was one other matter upon which he confessed the Water Companies felt very strongly. They did think—and he was very much disposed to think others would share the view—that a Commission of this kind, taking evidence, could hardly get satisfactory evidence unless the witnesses were examined, and cross-examined, and re-examined by Counsel.

The CHAIRMAN said Mr. Hollams need not re-open that subject. They were not going to agree to it.

Mr. HOLLAMS could only say this was the strong conviction of the Companies; but, of course, they must bow to the decision of the Commission.

Mr. H. L. CRIPPS thought that (as responsible for the case of the London County Council) he, after what Mr. Hollams had said, should perhaps address a few observations to the Commission, although Mr. Hollams's remarks were something of a general character and scarcely directed very specifically to the question of procedure, which the Commissioners wished discussed. Of course, his Lordship was aware that the case of the London County Council was certainly a peculiar one; and their position was one of very considerable difficulty in this matter. It was perfectly true that the Commission was asked for by the London County Council in the first instance; but it was not so much because they had any accusation to make against the Water Companies—it was because there was a considerable and growing feeling in London that inquiry into the matter of the water supply was really essential.

The CHAIRMAN remarked that they need not go into why the Commission was appointed. Mr. Cripps should rather address himself to the question of procedure, and what information he was prepared to give them in the first branch of the inquiry.

Mr. CRIPPS said the Commission having desired such information as the London County Council could supply, he had been instructed to at once communicate with those gentlemen whom the Council had been consulting as their advisers; and he should be prepared, in accordance with the desire of the Commissioners, to lay before them, at a very early date at all events, such evidence as might be offered on behalf of the Council. But there again, if he might be allowed to allude

to the difficult position of the Council, that body were perhaps really less informed of the specific matters which the Commission had to inquire into, than many other parties to the inquiry. Then he did not know whether the Commission might think it desirable, in the first instance, to deal with the question between the County of Hertford and the Water Companies deriving their supplies from that neighbourhood—a question which was exceedingly important, and with which the County of Hertford was thoroughly familiar, and with which he believed its representatives were nearly ready to proceed, and would do so in a much more authoritative manner than any witnesses could whom he might bring forward. Sir Richard Nicholson was present, representing Hertfordshire, and would be able to give explanations; and as a matter of general convenience, it might be better that that county should come before the Commission at the instance of its representatives.

The CHAIRMAN observed that Mr. Cripps was going rather further ahead than the Commission wished. They should judge of the order in which the evidence should be taken, when they knew what the character of the evidence was which was going to be submitted; and they must know what line was going to be taken. They understood, however, that the parties were quite agreeable that what he called the geological evidence should remain over till later.

Mr. CRIPPS believed so.

The CHAIRMAN then stated that they proposed to take the London County Council after the Water Companies upon any points in the first branch of the inquiry, on which they might reasonably give the Commission assistance. The Commission wanted the Council's opinions as to the population that would have to be provided for, as to the amount of water required per head, and so on; and the Commission did not see any reason why in a fortnight's time from that day the Council should not be ready to give their information and assistance. The Commission had now been going on two months and a half; and during that time the Council should have been preparing to submit evidence.

Mr. CRIPPS mentioned that the Council had been preparing; and, of course, if the Commission decided that they should come forward in the first instance as suggested, it would be their duty to submit.

The CHAIRMAN pointed out that the Commission did not dictate. But if the London County Council were going to give information, or express any views at all, they should do so at this stage, and not keep their opinions to themselves until the inquiry had been far advanced.

Mr. CRIPPS asked if his Lordship would intimate what day the Commission would desire to have these opinions laid before them.

The CHAIRMAN replied that they hoped to take the London County Council on Monday, the 13th inst. But they would not go further into that at the present time.

Sir RICHARD NICHOLSON presumed that Hertfordshire would follow the London County Council; and he subsequently stated that the former would be prepared to submit evidence before the 1st prox.

Mr. HOLLAMS offered another remark. He said the Water Companies should certainly desire to see the case of the London County Council, and learn how far it required answering. It was extremely difficult for the Companies to take the initiative now; and surely the County Council should be prepared with their case after all their expenditure on inquiries in the last year or two.

The CHAIRMAN pointed out that the Commission wanted to know, in the first instance, what everybody's case was, before everybody knew what everybody else's case was.

Mr. HOLLAMS suggested that then the Water Companies should not be tied down to what they sent in primarily, as they might have to refute some theories, &c.

The CHAIRMAN allowed that there was a great deal of force in Mr. Hollams's contention; but he said that, so far as anything the Water Companies wanted afterwards to put in was directed to answering what somebody else had put in, the Commissioners should be prepared as reasonable men to consider it. But they were very strong on this point—that anything of the sort subsequently put in, must be strictly directed to refutation, and not to the introduction of new matter.

Mr. HOLLAMS said they must bow to the decision of the Commission; but he suggested that it was entirely novel not to be made acquainted with the nature of the evidence of the opposite party before committing themselves. It was possible (but hardly satisfactory) to put in counter-statements; and, of course, the Water Companies could do it, but it would inevitably lead, he thought, to supplementary statements.

The CHAIRMAN added that the Commission had fully discussed the matter; and he repeated that they were of opinion that it was advantageous that they should know what was going to be submitted in evidence before they settled the order any further.

Mr. CRIPPS reverted to the difficulty experienced by the London County Council in preparing their case; and he asked if they might have till the 1st prox. instead of to the 13th inst. for the purpose.

The CHAIRMAN replied that the 1st of July was too far distant; and he remarked that the Commission would have to bear all the blame if the inquiry dragged on to the injury of people's interests. Besides, they thought that the County Council should have had time to be ready by the 13th inst.

Mr. CRIPPS said he felt, as Mr. Hollams did, that it was extremely difficult for either party to prepare a case of any sort in an inquiry of this kind until, to a certain extent, evidence had been adduced for the other side.

The CHAIRMAN said: You are all struggling for exactly the thing we are determined to prevent. He added afterwards, with regard to the expert evidence to be taken, that it should be submitted during July, and should be as far as possible from personal knowledge and personal observation, and that a full indication or account of it should be sent in (in writing or print) by the 1st prox.

Additional evidence on behalf of the Lambeth Water Company was then taken.

Mr. *S. H. Louttit*, the Secretary and General Manager of the Company, being recalled for the purpose of giving it, remarked that the Chairman had asked some questions to which he would now reply. The largest average daily quantity of water pumped by his Company in any one week was 22,561,743 gallons in the week ending Jan. 23, 1891. The largest quantities of water ever pumped in any three consecutive months were in Dec., 1890, and Jan. and Feb., 1891, when the total of the monthly average per day for three days was 61,733,653 gallons; and the average per day for three months was 20,577,884 gallons. The average per day for the months of July, Aug., and Sept., 1887, was 20,268,231 gallons; for the same months in 1889, 20,439,600 gallons; and for Jan., Feb., and March, 1891, 20,420,820 gallons. With reference to a question by Mr. Mansergh, on paragraph 64 of the printed statement, it appeared that the quantity per supply was estimated in 1911 to be, for all purposes, 19·52 gallons, as against 25·89 gallons at present per head in the constant supply districts. Assuming 175 gallons per supply, that would be 25 gallons per head, or only 0·89 gallons less than it was at present. Assuming further an increase of 37,180 new supplies in the second twenty years, ending 1931, that would be an additional annual quantity of 5,506,500 gallons, at 175 gallons per supply or 25 gallons per head. Therefore, adding to the quantity stated in paragraph 64, of 22,904,525 gallons, the 5,506,500 gallons just mentioned, they had a total of 28,411,025 gallons, which would afford 175 gallons per supply, or 25 gallons per head of the population. To meet this possible demand, the Company had, from the Thames and gravel-beds, 30,500,000 gallons, irrespective of the water that could be obtained from the chalk; and the Directors were advised that they could obtain 3,000,000 gallons per day from a well at Selhurst.

Mr. *T. F. Parkes*, Engineer to the Company, also gave evidence and emphasized the remarks which had been made as regarded having more control over fittings. If the Water Companies of London had as much control over fittings as the corporations and provincial companies had, the reduction of the great waste in the Metropolis would be much facilitated. In other words, efficient control of fittings was a necessary incident to the proper working of any constant-supply system. He did not want to limit the supply of fittings to any particular tradesman, but simply to have them brought to the Companies to be approved and stamped.

Mr. *Joseph Lucas*, as a geologist, next came forward to speak to certain statements of the Southwark and Vauxhall Company. He gave it as his opinion that that Company could from the Streatham well raise at least 3,000,000 gallons a day without altering the flow of water in the Wandle, but affecting perhaps wells within 1¼ miles in a certain direction.

Mr. *W. Topley*, F.R.S., gave evidence confirmatory of this.

The Kent Water Company's case was then proceeded with.

Mr. *Alexander Dickson*, the Secretary to the Company, spoke of the monopoly of supply in the Company's district, which was a prominent feature of their business. He pointed out that their sources of supply were fourteen deep wells; and he explained some of the details of the Company's statement sent in. He also mentioned that the number of houses in their district having the constant supply was increasing every year; and his experience of the supply was that, with a fair treatment on the part of the consumers, there was nothing in it detrimental to the Companies. The results of the constant supply on his Company's tables did not indicate any increase in the quantity of water per head of the population supplied; and no doubt, with efficient fittings and proper control, the average supply per head could be greatly reduced. He added that the 30 gallons per head per day estimated as a future supply might be reduced considerably; and it would not, he thought, be exceeded with proper precautions. In fact, while the amount of water which the Company supplied had increased by 6,500,000 gallons in the last twenty years, he did not think, having regard to the circumstances of the district, that it would increase to a greater extent in the next twenty years. In the last five years, the increase had shown a very sensible diminution.

Mr. *W. Morris*, the Engineer to the Company, testified to the ability of their present works to maintain the supply and even get it in excess.

This ended the preliminary investigation on the statements of the Water Companies; and the CHAIRMAN intimated that the Commission had been much gratified by the readiness and willingness of the Companies to supply information and facilitate the inquiry as far as they could.

The Commission then adjourned till the 13th inst. (yesterday).

Fenton Local Board Gas Department.—The annual report of the Fenton Local Board Gas Committee for the year ending March 28, 1892, states that the make of gas was 48,754,000 cubic feet; being an advance of 2,492,000 feet, or 5·38 per cent. for the year. The unaccounted-for gas was at the rate of 10·23 per cent.; being 0·23 per cent. less than in the preceding year. There was an increase in the make per ton of coal carbonized of 340 cubic feet. The total receipts amounted to £8475; being an addition of £492. The gross profits were £3486; and after providing £2137 for interest, and £28 for instalments on principal, a net profit is left of £921, which, added to the balance brought forward (after paying £300 to the Board), makes a sum of £3501 to the credit of the profit and loss account. The report was presented at the last meeting of the Local Board, and was considered a very satisfactory one.

Opening of Gas-Works at Woking.—For many years past the necessity of a gas supply for Woking has been severely felt, and accordingly it is gratifying to note that the enterprise of a number of gentlemen has at length provided for a supply to the neighbourhood. Last year the Woking District Gas Company, Limited, obtained a Provisional Order, conferring upon them powers to supply Woking, Horsell, Send, Ripley, Pyrford, and Byfleet. The buildings were at once commenced, and have been finished to the satisfaction of all concerned. The works, which have been erected on a freehold site in the Boundary Road, have been carefully designed by Mr. Jabez Church, of 55, Parliament Street, S.W., the Consulting Engineer to the Company, and have been carried out in a most satisfactory manner by the contractors, Messrs. Alfred Williams and Co., of Bankside, Southwark. A large number of consumers have already had the gas laid on, and further applications for supplies are being received. Mr. T. C. Webb, son of the Manager of the Egham and Staines Gas Company, has been appointed Manager. The works were formally opened last Thursday by Mr. C. H. Master, Chairman of the Company.

NEW GAS-WORKS FOR THE IMPERIAL OTTOMAN GOVERNMENT.

A very interesting ceremony recently took place at the Imperial Ottoman Gas-Works, Constantinople, on the occasion of the cutting of the first sod of the foundations for the new retort-house and gas-holder-tank. According to an ancient Moslem custom, rams were sacrificed, and their blood sprinkled on the threshold; while Mussulman priests recited prayers from the Koran invoking the protection of Allah upon all true believers engaged in the work. A large number of Turkish notabilities were present; amongst others, the Chief of the Building Commission (Hassip Bey), the Architect to the Administration of Tophane (Oannes Bey), the Engineer of the works (Mr. W. S. M'Gregor), members of the Council of Tophane, and others. About two years ago, the Imperial Government finally decided to erect new works, and several firms submitted designs. The Government, however, selected the one prepared by their own Engineer. It embraces the construction of complete works capable of producing a million cubic feet of gas per day. The retort-house is 70 feet wide by 130 feet long, and 34 feet high to the wall-plate. It will contain eight settings of Ω retorts 22 in. by 16 in. and 20 feet long, set nine in an arch, making altogether 144 mouthpieces. These retorts are brick built, and will be fired on the regenerator system designed and adopted by Mr. J. F. Bell, Assoc.M.Inst.C.E., Gas Engineer of the Stafford Corporation, in whose works these retorts are in use, giving great satisfaction. The annular wrought-iron condensers consist of eight columns 32 ft. 8 in. high over all, and 3 feet in diameter. The exhauster-room is 36 feet by 30 feet, and will contain two pairs of exhausters, each pair coupled up direct to one high-pressure steam-engine. The boiler-house is 24 feet by 30 feet, and will contain three boilers of the Cornish type, 22 feet long and 5 ft. 6 in. diameter. A pump-room 17 ft. by 30 ft. will contain a set of pumps in duplicate for tar, ammoniacal liquor, and water, each pair being complete with an engine on the same bed-plate. The washer will be of the Livesey make, and be capable of passing 1½ million cubic feet of gas per 24 hours. The scrubbers are 8 feet in diameter and 50 feet high. The purifying-house is 130 feet long by 50 feet wide, and will contain four purifiers, each 24 feet square and 6 feet deep. The meter-house is 31 ft. 6 in. square; and attached are laboratory, test-room, and other offices. The ground for the new works is limited in extent for gasholder storeage; and, consequently, at present only one two-lift holder of 300,000 cubic feet capacity will be put up, as ground for future storeage must be looked for elsewhere. The buildings are being erected by the Building Commission of the Government, from plans and specifications prepared by the Engineer, who has also the superintendence of their erection. The various contracts for the ironwork have been placed with leading firms of gas engineers in England; and the works are being rapidly pushed towards completion.

BRUSSELS MUNICIPAL GAS SUPPLY.

Gas Committee's Report for the Past Year.

The following is an abstract translation of the report of the Gas Committee of the Municipality of Brussels on the working of the gas undertaking during the twelve months ending Dec. 31 last:—

The total quantity of gas produced in the past year was 27,847,210 cubic metres, or about 983 million cubic feet, as compared with 25,903,640 cubic metres, or about 918 million cubic feet, in 1890. It was disposed of as follows:—

	Cubic Metres.
Night gas, at 14c. per cubic metre	16,504,321
Day gas, at 10c.	2,678,620
Municipal establishments, at 10c.	888,318
Gas-engines, at 10c.	811,872
Industrial purposes, at 10c.	198,097
Illumination devices, balloons, &c.	154,045
Artisans' dwellings and miscellaneous	59,071
Total sold	21,294,344
Public lighting and illumination	4,124,819
Used on the works, &c.	831,227
Unaccounted for	1,596,820
Total production	27,847,210

The total sales of gas exceeded by 1,414,973 cubic metres, or close upon 50 million cubic feet, those of 1890; but the extra quantity sold was mainly at the lower charge. The working expenses amounted to 3,984,562 frs. (£159,382), which were increased to 4,187,994 frs. (£167,520) by the expenditure of certain sums to order. The principal receipts were as follows: Gas, 2,786,793 frs.; coke, 1,229,020 frs.; tar, 192,791 frs.; ammoniacal products, 123,269 frs.; spent purifying material, 15,061 frs.—other receipts making up a total of 4,731,497 frs. (£189,259). The balance in favour of the Municipality at the close of the year was therefore 543,503 frs.; but as a sum of 257,930 frs., included in the general expenditure, had been spent in increasing the stocks, this amount should be added—making the total profit on the working of the undertaking 801,433 frs. (£32,057), as compared with 1,395,759 frs. (£55,830) in 1890. This was a falling off to the extent of 594,326 frs. (£23,773). This unsatisfactory result is attributable to the reduction of 1c. per cubic metre (about 2·7d. per 1000 cubic feet) in the price of gas; also to the higher price of coal and the reduced value of coke. With regard to manufacturing operations, something like 100,000 tons of coal were carbonized; the cost being 22 frs. 50 c. per ton, as compared with 18 frs. 58 c. in 1890. The contracts entered into for the current year, however, are at a reduction of about 3 frs. on the rate lately paid; and even better terms are anticipated. Coke fetched only 22 frs. 3 c. in 1891; whereas in 1890 it sold for 22 frs. 96 c. Notwithstanding the low price, the stocks were not cleared off; and consequently the yards were rather encumbered with this residual at the end of the year. The retail sales continue to increase; and additional outlets are being sought, so that something like a regular clearance may be effected. At present the tar is disposed of by contract; but a project is on foot to set up a distillery on the works. The same conditions obtain with respect to ammoniacal liquor, which will probably, before long, be treated on the spot. Spent purifying material fetched 15,061 frs. Something like 12,000 tons of breeze, resulting from the breaking of coke, were utilized, with admixture of pitch, in the manufacture of compressed fuel. The extension of the works continues. The storeage capacity is being increased by the erection of a gasholder capable of containing close upon 1½ million cubic feet of gas; and it is expected that the work will be completed by August next year. The amount expended on capital account up to the end of 1890 was 14,455,099 frs.; and the purchase of land last year brought the total up to 14,650,149 frs. (£586,006) at the close. The distributing system has lately been inspected, with the view of discovering the cause of leakage. Out of 351 repairs made, 65 were caused by fracture of the pipes; but no escape was detected from joints made with india-rubber rings. The total length of mains at the end of 1891 was 1,796,896 yards. The number of meters then in use was 14,852, of which 7495 were of the double-index class. As the Council declined to agree to the proposal to abolish differential prices, and sell both day and night gas at the same figure, meters of this class are still put up, although they are found to require much repair. The system of supplying gas to the various floors of tenement houses by means of rising pipes, as in Paris, continues to extend. The number of these pipes in use on Dec. 31 last was 855—an advance of 217 on the number at the close of 1890. Interior fitting is undertaken by the agents of the Municipality. Fittings are put in on hire, at the rate of 5 per cent. per annum; or they are purchaseable by eleven annual payments equal to one-tenth of the outlay incurred. On Dec. 31 last there were 1244 sets of fittings on hire, as compared with 766 at the corresponding period of 1890. Another branch of operations is the placing of gas-stoves. This business was started in September, 1890; and by the end of the year 1348 stoves had been put in. They comprised 688 hot-plates, 201 roasters, 9 kitcheners, and 450 heating-stoves. At the end of last year the total was more than doubled—the number being 2965. The 1617 additional stoves comprised 614 hot-plates, 353 roasters, 28 kitcheners, and 622 heating-stoves. This is assuredly evidence of enterprise. With regard to gas employed for motive power, 26 gas-engines were fitted up last year, bringing up the total to 200, or equal to about 667-horse power. The consumption of gas in these engines reached to nearly 30 million cubic feet. In the department of public lighting, there were in use at the close of the past year 5578 gas-lamps, of which 404 were furnished with high-power burners. Of the latter, 401 are extinguished between midnight and one o'clock in the morning, as well as 369 ordinary lamps.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday, at the London Offices, No. 60, Gracechurch Street, E.C.—Mr. J. BIRCH PADDON in the chair.

The SECRETARY (Mr. A. W. Cooper) read the notice convening the meeting; and it was agreed to take as read the Directors' report and accounts for the year ending March 31 last, an epitome of which appeared in our issue of the 17th ult.

The CHAIRMAN said the shareholders would find in the report a formal announcement of the death of Mr. Charles Newton, who was an exceptionally good Director, and who gave the Company the full advantage of his large, special experience. He was a man of the highest principles; he secured the esteem of the whole of his colleagues; and he (the Chairman) was quite sure he would be kindly remembered by all who knew him. The Company and the Board had both been distinctly strengthened by the acquisition, as a Director, of Mr. Stephenson R. Clarke, who was the largest holder of the Company's shares. Apart from these incidents, the past year had been by no means uneventful. The Directors had had to contend with dear coal, a reduction in the price of gas, and competition with the electric light; and these things had given them plenty to do, and caused them some anxiety. On the other hand, they were able to point to an increase of business from all the Company's stations; and this left them a decent balance to the good. The extent of this balance would be shown by a comparison of their accounts with those of some English gas companies, whose working exhibited increased prices, reduced profits, and depleted reserves. Many things had happened in Malta to depress trade, and to check the consumption of gas. There had been a total absence of the usual festivities (at which a good deal of gas was generally used), owing to the death of the Duke of Clarence and some persons of local importance. Then, again, Malta depended very much upon the ships calling there, the number of which had been seriously diminished, in consequence of the Russian famine, and the large decrease in the coal trade. But notwithstanding these adverse circumstances, the Company's rental in Malta showed an increase of 7 per cent.; and as this arose entirely from private consumption, it was all the more satisfactory. In October last, some proposals were made by Mr. Preece, the eminent electrician, for the supply of electricity to the naval and military establishments, and for public lighting. These proposals were favourably considered by the Chief Secretary, and by him laid before the Council, who, however, failed to see that any advantage was to be gained by their adoption. It seemed to them that it was simply the substitution of a dear mode of lighting for a cheap one, and, moreover, it involved the expenditure of all, or nearly all, their accumulated funds, upon which they set great store. Consequently the consideration of the proposals was adjourned; and the Directors were still waiting to hear the result. In connection with this subject, he ought to mention the services rendered to the Company by their General Manager (Mr. J. W. Starkey). The promoters of the electric light were not always very accurate in their statements; and Mr. Starkey managed to deal with the fallacies, as they appeared, in a very satisfactory way—all the misstatements were refuted; and no doubt the electricians were temporarily discomfitted by the exertions of Mr. Starkey. During the year there had been some considerable improvements made at Malta—the manufacturing and purifying plant had

been extended, and a new 14-inch main had been laid from the works to the middle of the Valletta district—the result already having been very satisfactory. But the principal work that had been done in the course of the year had been the extension of the mains to Sliema, which was a fashionable adjunct of Valletta. It was on the opposite side of the harbour to Valletta; and, in consequence, they had to take the mains round the end of the harbour, and thereby incur a heavy expense—an expense which was proportionally large to the immediate business. There was no doubt, however, this extension would be a profitable one; and meanwhile the Company had the credit of having complied with an urgent public demand, and had conferred an undoubted public benefit. As to the question of concentrating the manufacturing operations by discontinuing the works at Calcara, and only using those at Valletta, nothing had yet been done; but as the business increased, so the desirability of the alteration increased. As, however, it was entirely governed by financial considerations, and as there was no great urgency, the matter stood in abeyance for the present. At the Sicilian stations, the chief subjects of interest during the year had been the reductions of the price of gas and their effects. It should be understood that the bulk of the Company's rental arose from the public lamps, and that rental was entirely unaffected by the decrease in price. The abatement applied solely to the private consumers; and their response to the reduction (which was a bold one—from 11s. to 7s. 6d. per 1000 cubic feet) was an increase in consumption of 47 per cent. The Directors were, of course, highly pleased with this result; and they had a reasonable expectation of still further increase. At Trapani, they had had to lay additional mains; and at Marsala more retorts and manufacturing plant had had to be put down. At Corfu matters had been unsettled throughout the year. In December last, their contract for lighting the public lamps at this place expired; and since then they had been lighting the lamps under a temporary arrangement. The Municipality had contracted for the supply of electric lighting; but at a price so low that it was presumably for the purpose of advertisement more than anything else. The price charged for the gas supplied to the public lamps there was (in consequence of the rise in the rate of exchange) scarcely remunerative. Therefore the loss to the Company was comparatively unimportant, so far as profit was concerned; and they would have to look for a recoupment in the increased sale of gas to private consumers. The same reduction was made in the price of gas at Corfu as at the Sicilian stations; and the result had been an increase in consumption of 24 per cent. Had the contract for public lighting been renewed, the Company would have had to incur considerable outlay at Corfu in additional manufacturing plant, gasholders, and mains; and, of course, that was not now wanted. Turning to the accounts, the Chairman said, beyond the increase of loan capital, and the expenditure mentioned in the report, there was not much to be said. Their position was this: They had money enough to pay for the extensions already executed, and for all the things to which they were committed. Further extensions, however, would have to be made; and for this capital would have to be raised. As he had already said, there was no urgency in this matter; and before anything was done, a special meeting of the shareholders would be called to obtain their sanction to the raising of further capital. There was one item in the general balance-sheet to which he should call attention. It was that of "Stocks at stations, £11,369," which was £3400 more than in the previous year. The explanation of this was that the Directors thought it desirable that the stocks of coal should be increased—circumstances not being very satisfactory in connection with the coal trade—and the bulk of the £3400 was represented by the additional quantities at the stations. The stock of fittings had also been augmented, in consequence of the larger trade; and the percentages of increase in consumption which he had mentioned justified this. As to the profit and loss account, the first item was that of coal, which was £1178 more than in the previous year; but they used a further 1262 tons, so that the difference was chiefly accounted for by this. The increase in the cost per ton was very little, owing to their having been able to bring forward a considerable stock purchased at the old contract price; but they were now face to face with the full weight of the price of coal. Wages were about £385 more; and this was almost entirely due to the larger make of gas. The charges on street lighting were about £84 less than in the preceding year. The item of maintenance was £897 more; and this was chiefly for the renewal of retorts and mains at Malta. Depreciation of stock was higher by £203. This was in consequence of their having larger stocks; the percentage of depreciation being the same as formerly. The item of exchange had risen by £195. In the preceding year, it averaged 33·6 per cent.; while in the past year it averaged 36·6 per cent.—being an advance of 9 per cent. This 9 per cent. had converted the selling price of gas at Corfu—he would not say into a loss—but it was very near to the cost price. Coming to the working, the Chairman said they had used 11,401 tons of coal; and they had made from this 117,000,000 cubic feet of gas, which was equal to 10,276 feet per ton. They had sold 109,000,000 feet, which was at the rate of 9129 feet per ton. This was an increase upon the sale of the previous year of close upon 10 per cent. The differences between the quantity manufactured and consumed was 13,000,000 feet, which made the percentage of unaccounted-for gas 11·15. This was decidedly more than it ought to be and more than it was last year. There had, however, been a good deal of loss through main laying, of which more had been done in the past year than in any previous year. The process of main laying in their case was a somewhat difficult one, as they had every night to charge with gas the mains laid during the day. The Directors had also thought it necessary to have some experimental lighting at Malta and Corfu; and this helped to increase the unaccounted-for gas. The gas-rental (£27,669) was £878 more than in 1890-1; and considering the large reductions made in the price, he could not help thinking this was most satisfactory. In the next items—coke, tar, and pitch—there was an increase of £393. With the extra quantity of coal used, they would have liked to have seen a larger return than this; but the average price of coke had been somewhat lower. In fittings, they had had an increase of £131; and this all came from the smaller stations. The return on account of fittings was satisfactory from Malta; but it was small, compared with the preceding year, when they did a very large and quite a special amount of work for the Government. These increases helped them to a profit of £10,678; and although this was £1635 less than it was in the former year, it allowed the payment of the dividends to which they had been accustomed, the full amount to be transferred to the reserve fund (£1500), the full charges for depreciation and interest, and left the satisfactory balance of £2412 to be carried forward. At the first blush, it might reasonably be said, "Why not pay a larger dividend on the ordinary capital?" There was much, however, to be thought of. This year, they were sure to have to meet a large increase in the cost of coal; and they had not yet done with the effect of the reduction in the price of gas. Then there was the Corfu contract; and they could scarcely tell how they would be affected by it. Looking at all these things, he thought it would hardly be becoming on the part of the Directors to recommend the shareholders to appropriate more than the usual sum; and, from experience, the Directors knew the general feeling among the proprietors was a preference for a continuous, rather than a fluctuating, dividend. The Chairman concluded by moving the adoption of the report and accounts.

Colonel JAS. LE GEYT DANIELL seconded the motion, which was at once carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. J ORWELL PHILLIPS, dividends at the rate of 7 per cent. on the first preference shares, of 7½ per cent. on the second preference shares, and of 6 per cent. on the ordinary shares were then declared.

The retiring Director (Colonel Daniell) and the Auditors (Messrs. R. Hesketh Jones and T. Guyatt) were re-elected; and the proceedings terminated with votes of thanks to the Chairman and Directors and officers for the continued interest they took in the affairs of the Company.

BUENOS AYRES (NEW) GAS COMPANY, LIMITED.

The Annual Meeting of this Company was held last Wednesday, at No. 1, East India Avenue, E.C.—Sir WILFORD BRETT, K.C.M.G., in the chair.

The SECRETARY having read the notice convening the meeting, it was agreed to take as read the Directors' report and the accounts, a summary of which was given in the JOURNAL last week.

The CHAIRMAN said this was the seventeenth year it had been his privilege to address the shareholders at their annual meeting; and, with the exception of the first two years, there had been no year in which the Directors had had greater difficulties to encounter than in the past one. It had been a most anxious time indeed for them; but he hoped and believed they had now weathered the storm, and had passed into less troubled waters. He wished to explain to the shareholders the real state of their affairs; so that they might understand the difficulties that had had to be met, and so that they might, notwithstanding those difficulties, recognize that there was a stability and solidity in the Company upon which they might still rely. To carry this out, his best course would be to divide the facts as they really existed into two categories — first, those matters over which the Directors had control; and, second, those over which they had no control at all. Dealing with the first category, which included the volume and results of the working, the number of private meters fixed had increased from 9557 to 10,230. The gross income in currency had advanced from $2,067,992 to $2,182,493. This was the largest amount, in dollars, that had ever been earned by the Company since its formation; and it showed that the business continued to satisfactorily increase. They had obtained the assent of the Municipality to an advance of 50 per cent. in the charge for public lighting, and also to a reduction in the number of lamps. This decrease was not only an advantage to the Municipality in their present financial troubles, but it prevented any material increase in their debt to the Company. The Directors had also been successful in raising the price to the private consumers; but they had a great many obstacles to overcome before they were able to accomplish this. The Chairman then proceeded to give some figures from the working returns, which, he remarked, showed that the result of the year's operations was not in any way caused by the manner in which the business had been carried on, but solely by the extraordinary price of paper and gold. The average production of gas per ton of coal was 10,300 cubic feet of 23-candle power, and the yield of coke 17 cwt. To carbonize 100 tons of coal, 18 tons of coke were used as fuel. The unaccounted-for gas amounted to 275,000 feet per mile of main for the whole year; and, considering the difficulties their Manager had to meet, not only in carbonizing but distribution, he was sure that anyone who understood these matters would know that the figures he had given were very satisfactory, and that there were few companies, so far away from the coal-fields as they were, who could show better results. The works, he continued, had been kept in a perfect state of repair; and the local expenditure had been curtailed. No capital outlay had been incurred beyond what was required for a few mains that they were compelled to lay down to meet existing contracts. He ought to have mentioned that the change in the price of both public and private lighting came into operation so late last year that it had not affected very much the accounts now under review; but full benefit would be derived from them in next year's accounts. The great apprehension of the Directors was that, through the financial and political troubles, their customers would fall off, and that the bad debts would increase. Happily their accounts showed just the contrary—their private customers had increased, and the bad debts were not larger than they usually were. He thought, this was owing to a certain extent to the fact that the main-cocks which had been fixed outside the houses enabled them to cut off the supply of gas without going inside, in cases where the consumers did not pay. During the year they laid on 1087 new services, as against 1344 in 1890. Turning to the reverse side of the sheet, there was no doubt the year had been to them, in common with other Companies doing business in Buenos Ayres, one of great uneasiness and loss; and it was really wonderful to him that the depression in their Company was not worse than it had been. The real factor against them, and which had been quite outside the region of their control, had been the price of

paper, which had averaged 275. This had made it difficult not only for them to make any headway but to hold their own at all. However, they were enabled to hold their own; but the Directors were not in a position to pay the shareholders a dividend, and there was no gas company in Buenos Ayres which could pay one. He was pleased to be able to say that there was a brighter light looming in the distance; and they might henceforward look for better things. Why he said so was this: The harvest had been an abundant one; and the Presidential election would soon take place, and then he believed there would be more steadiness and stability in the Government itself. There was also a disposition to curtail the issue of paper money, and if this should have the effect of improving the value of the paper dollar, one of the Company's chief difficulties would be overcome. What he wished to impress upon the shareholders was that the earning power of their property was not one whit less than it had been; but what was worse was that the paper dollars they took as payment were not available for dividend purposes. In the past year, they had lost enormously by the conversion of dollars into gold. At par $5 were equal to the pound sterling; while at 373—the rate ruling on Dec. 31, the date on which the accounts were made up—it took $18¾ to the pound. Having mentioned that, in order to meet the provisions of a local Act which imposed a tax upon the profits of companies doing business in the Argentine Republic, they had been obliged to change the form of the accounts from the fluctuating currency to a gold basis, the Chairman mentioned that the Directors had lately had the benefit of conferring with their able Manager (Mr. Lewis T. Wright), who had been in England, and added that the prudence and zeal he had shown in conducting the business of the Company was beyond all praise, and they owed to him, the local Committee, and the staff, their very best thanks.

Mr. R. NESHAM, in seconding the motion, remarked that he was the largest shareholder in the Company; and with all the troubles they had gone through during the year, he had never lost hope or confidence in the future.

Mr. S. SPENCER said he saw a short time ago a report relating to a lawsuit in which the Company were concerned; and he should like the Chairman to give the shareholders some information in regard to it. He suggested that it would be more in accordance with the practice of other gas companies if the item of cargoes at Buenos Ayres and afloat (which stood in the accounts on this occasion at £56,132) was set out in detail; so that the shareholders might know what that large sum covered. He should also like a little explanation as to the net revenue account. On the debtor side they had debenture interest £12,000; and on the other side the profit for 1891 was shown as £393. Had they only £393 to pay the debenture interest, or had it been paid?

The CHAIRMAN replied that they had a balance from 1890 of nearly £9000; and, by taking £2800 from the reserve fund, they made up the amount needed for debenture interest.

Mr. CUFF asked whether, now that the Company were keeping their accounts on the gold basis, there was any reason why the Directors could not give the shareholders a proper profit and loss account, instead of the curtailed statement they now had.

Mr. GROVER, referring to the reserve fund of £66,395, inquired if that was calculated on the gold basis. He also asked whether the Company were endeavouring, in conjunction with other companies, to bring the Argentine Government to a proper condition of mind. It was very wrong of them to go on issuing paper, and so depreciating property.

The CHAIRMAN, in reply, said the reserve fund was on the gold basis now. As to Mr. Grover's second remark, he (the Chairman) did not fail to use what influence he might possess on behalf of the Company. He had communicated with the Foreign Secretary, who had taken the matter up, and sent it forward to the English Minister at Buenos Ayres. He had received very kind answers; but it appeared there were difficulties in the way. As to the question regarding the lawsuit, he could not say much about it at the present time, because it did not come into the past year's working, and an appeal had been entered against the decision. [*Ante*, p. 806.] Respecting Mr. Cuff's question, he might say that, with so much competition against them, they did not like to give too many details in the accounts; but shareholders might get all the information they required by applying at the office.

The motion was then unanimously carried.

The retiring Directors (Sir Wilford Brett and Mr. J. Conrad im Thurn) were re-elected; and the appointment of Mr. Ross Pinsent as a member of the Board was confirmed. The Auditors (Messrs. Turquand, Youngs, and Co.) were also re-elected.

On the motion of Mr. R. L. ANDREWS, a vote of thanks was passed to the Chairman and Directors for the diligent attention which they bestowed upon the affairs of the Company.

The Water Supply of Stainland.—The Huddersfield Corporation have agreed to supply the Stainland Local Board with 80,000 gallons of water per week, for a period of twelve months, at 9d. per 1000 gallons. For some time past, the water supply of the township has been insufficient.

The Vyrnwy Water Supply.—The first line of permanent pipes through the Mersey tunnel was completed last Wednesday. The pipes are 12-inch cast-iron ones, and are capable of conveying four million gallons of water a day into Liverpool. The other lines are laid, but not yet connected. When finished, they will be able to carry a total supply of 14 million gallons.

The Pollution of the Water Supply of the Rhondda.—A deputation of the Rhondda Valley Chamber of Trade, appointed to visit the intake of the Ystrad Gas and Water Company, has reported that, on the 1st inst., they found "abundant evidence that dirty waters from the Blaenrhondda colliery levels were flowing into the stream above the intake, and that these were mixed or polluted with human excrement." It is stated that representative ratepayers in the various populous localities throughout the district will wait upon the Sanitary Authority to request them to institute legal proceedings immediately against the Company unless the intake be removed without delay to a place above the mouths of the colliery levels.

TIPTON LOCAL BOARD GAS SUPPLY.

Annual Report.

The report of the Gas Engineer (Mr. Vincent Hughes) on the results of the working of the concern under his care during the year ending March 25 last, was laid before the Tipton Local Board at their recent monthly meeting; and it exhibited substantial progress all round. The manufacturing statement showed that the coal and cannel carbonized amounted to 9133 tons, as against 8428 tons. The quantity of gas produced was 96,778,000 cubic feet, as compared with 86,711,071 feet; the make per ton of coal being 10,596 feet, as against 10,289 feet. The gas sold and used on the works totalled to 86,951,060 feet, in comparison with 78,739,280 feet—the unaccounted-for gas being at the rate of 9·93 per cent., while in the previous year it was 9·21 per cent The illuminating power averaged 17·72 candles. In commenting upon the report, the Chairman stated that the balance-sheet showed a gross profit of £4266; and a net profit of £169. In his opinion, this was a marvellous result; and he should not have been surprised if a serious deficiency had been reported. They had fallen on very evil times with regard to gas making; and they were not the only Committee who had found it out. If they could have suspended the repayment of loans for the year, they would have had a splendid profit. They had had many difficulties to contend with in the course of the year. They had carbonized 9100 tons of coal; and three years ago the price of coal was 3s. 6d. and 4s. per ton less than it was now. Taking the 3s. 6d. per ton, the rise in price, on 9100 tons, was £1598. Then there was the question of wages, in which there was an increase. In 1889 the whole amount paid was £793; and 7411 tons of coal were carbonized. The cost of wages per ton of coal was 2s. 1¾d. per ton. This year the cost of labour was £1435; and 9133 tons of coa were used. The cost of labour per ton of coal was 3s. 1¾d., or a rise of exactly 1s. per ton. During the year, they had certainly had an increase in the price of coke; but this was not equal to the advance in coal. They had also a very serious falling off in residuals. Tar, which used to sell at 48s. per ton, had to be sold at 24s.; and there was every prospect of having to dispose of it at 12s. per ton next year, as that was the price quoted in the markets. Then, again, they could get scarcely anything for their spent lime. They had advertised, but all to no purpose; and they were now offering it for 6d. per ton. In spite of all these difficulties, they had succeeded; and he thought it was a matter for congratulation. The report was adopted.

DUKINFIELD LOCAL BOARD GAS SUPPLY.

The Progress of the Gas Undertaking.

The Engineer and Manager of the Dukinfield Local Board Gas-Works (Mr. Harrison Veevers) has lately presented to the Gas Committee his report on the progress of the gas undertaking in the twelve months ending March 25 last, together with the accounts for this period. He states that an increase in the price of tar produced 0·4d. per 1000 cubic feet on the quantity of gas sold; but this was lost by the diminished price of coke and sulphate of ammonia. The market price of the latter was the lowest on record; nor are there any prospects of the prices of either tar or ammonia increasing—in fact, that of the former article will probably diminish. The new purifiers and oxygen plant which it was some time ago decided to put in, and the construction of which has been delayed by many causes, will shortly be in use; and then Mr. Veevers expects to be able to maintain the present illuminating power of the gas (about 18 candles) with the use of a lower proportion of cannel. From the tables accompanying the report (verified, as usual, by Mr. W. Moss, F.C.A.), we find that the net cost of making and distributing gas in the past financial year was 1s. 9·27d. per 1000 cubic feet sold, as compared with 1s. 9·23d. in 1890-91. The former figures were brought up to 2s. 8·79d. by the sums paid for annuities, interest, and the sinking fund; but as the present average price of gas is 2s. 9·02d. per 1000 cubic feet, there is shown a profit of 0·23d., as compared with 1·38d. in 1890-91, when the average price was 2s. 9·99d. The quantity of gas made was 63,244,000 cubic feet, of which 57,741,500 cubic feet were sold; so that 5,502,500 cubic feet, or 8·7 per cent., were unaccounted for. An interesting table gives the items of balance-sheets since the separation of the gas undertaking from Denton and Haughton; and the special features noticeable are the increased sale of gas per ton of coal carbonized, and the reduction in the leakage. The sales show a gradual rise, as follows; 1886, 8104 cubic feet; 1887, 8241 cubic feet; 1888, 8603 cubic feet; 1889, 8919 cubic feet; 1890, 9188 cubic feet; 1891, 9146 cubic feet; 1892, 9137 cubic feet. The figures showing the percentage of leakage go the other way: 20·82, 17·26, 15·84, 13·33, 11·06, 10·46, 8·70. The income from the sale of gas in the seven years was: £7506, £7816, £8050, £6953*, £7546, £7945, and £7943*; the asterisks indicating years in which the price was reduced. Mr. Veevers points out to his Committee that, with ample retort, scrubbing, purifying, and distributing plant, every means should be adopted to increase the sale of gas, and so reduce the proportionate cost of fixed charges, such as annuities and sinking fund. Some years ago he called attention to the large percentage of the inhabitants of Dukinfield who were using other illuminants than gas. Since then, however, prepayment meters have been invented; and he thinks the question of their introduction in the town might be worth consideration.

Llangollen Water Supply.—Mr. T. T. Marks, C.E., of Llandudno, has recently reported upon the water supply of Llangollen. The first portion of the document shows conclusively that the whole system is at present in a bad state, and that it is not advisable to spend more money upon it—the only effectual remedy being to construct entirely new works. Mr. Marks recommends as a new source of supply the Vivod Valley; and he suggests that the following works should be constructed: An impounding reservoir, to contain 2,000,000 gallons; a pressure-relieving tank to hold 100,000 gallons; and the necessary pipe-lines. The cost of carrying out these works in a substantial manner, including inquiry and law costs, he estimates at about £6700.

THE ELECTRIC LIGHT AT FAREHAM.

From a Correspondent.

Another example of the impracticability of supplying the electric light in small country towns, as a profitable commercial venture, is afforded by the progress of events at Fareham. The Electric Light Company was promoted by a member of the Local Board in this little Hampshire town, under every possible advantage that the local influence could secure, assured of the contract for public lighting, and of some private business besides. The supply of electricity was commenced in September, 1890; and the installation has been inspected by deputations from various places. Yet the result of sixteen months' working up to the end of 1891, is a very heavy loss—amounting to no less than one-half the actual receipts. Passing over the four months of 1890, we find the concern in fair working order at the commencement of 1891, supplying the street lighting, and also 21 consumers, representing 270 lamps. At the end of the year, this had only increased to the extent of seven consumers, leaving 28 customers, with 390 lamps, on Dec. 31, 1891. Such a slow rate of increase seems to show that there is not much prospect of further extension of business at Fareham; but the Directors, in their annual report, "most earnestly impress upon the shareholders the necessity of giving increased support to the Company, both individually, and by using their personal influence to increase the business." Apart from the question of introducing the electric light by means of "personal influence" in a town where the public already have the means of seeing what it can do, it should not be necessary to have to appeal for the individual patronage of shareholders. But perhaps one reason why these gentlemen have not hastened to avail themselves more fully of the advantages afforded by the electric light, is touched upon by the reference in a subsequent paragraph, to "little irregularities that have occurred in the past, which will in future be avoided." Yet shareholders are usually inclined to be lenient towards little irregularities, so far as the public lighting is concerned at any rate. The working for the year 1891 may be accepted as affording some indications of the practical conditions of electric supply. The total income for the year was £832—comprising public lighting, £502; private lighting, £252; and £67 gross profits from installations (from which it appears that the Company not only supply the light, but also do the fittings). But the expenditure for coal, wages, oil and waste, lamps and carbons, amounted to considerably more than this. Including the establishment charges, rents, taxes, &c., it comes to £1169, although no item for repairs or renewals is shown in the account. Giving the concern the benefit of any profit on the lamps, &c., we may put the receipts at £750, and the expenses at £1100. The outlay on capital account approaches towards £6000; and 5 per cent. interest on this would be £300. So that an income of £1400 would be required to afford a fair return for the shareholders; and it is evident that the electric light has been supplied at about half the price that would be necessary in ordinary business working. Coals and wages alone swallow up nearly the whole of the receipts. The private consumers appear to average something over a dozen lamps each, for which they pay about £10 per annum, or 16s. per lamp. With figures like these before us, it is evident that the electric light cannot be supplied in small country towns at anything like prices that would compare with those now paid for gas.

ELECTRIC LIGHTING AT BLACKPOOL.

The Superintendent of the Electric Lighting Department of the Blackpool Corporation (Mr. W. Chew) has just submitted a general report on the electric lighting of the Parade from its commencement, together with an analysis of last year's working cost per Board of Trade unit, and a few general remarks on the subject. The lighting between the two piers was commenced in September, 1879; and the original plant consisted of six arc lights, 60 feet high—two of them being on the extremities of the piers, for the use of which the Companies pay. The lights on the parade were, on an average, 330 yards apart; and the electric plant was put down on the low-tension system by Messrs. Siemens. The original machines and lamps are still at work. In December, 1879, the plant was placed under Mr. W. Chew's care, and has remained so to the present time. After an experience of two years, it was considered advisable to increase the light between the lamps erected; and three more lamps were added—making the average distance 160 yards apart. This, Mr. Chew says, made the lighting eclipse any other public lighting, for brilliancy, that has yet been attempted in this country, and added to the fame of the town. As advances were made in electric lighting, and small arc lights were introduced for street purposes, a reaction set in at Blackpool, and the policy of using such a blaze of light began to be questioned; it being thought that the smaller lights, extended farther, in lieu of the large ones, would answer the purpose as well. It was ultimately agreed to have a public test made by dividing each of the present lights into three. Separate poles and lamps were fixed, and the large and small lights were lit alternately. The unanimous conclusion was that, although it would be much cheaper to run small lights, the effect produced was inferior in all respects to that of the large ones; and Blackpool would not then occupy the first place for brilliant lighting. This decision put a stop to a scheme the Committee had in hand, estimates for which had been prepared, for the lighting of the north and south ends of the Parade by 40 small arc lights on the high-tension system. From that time until very recently, the decision arrived at then has not been assailed. In 1887 two more lights were added at the south end, by a private firm; and a Committee fixed the distance apart at 270 and 214 yards respectively, and 45 feet high. In the following year the bare poles were handed to the Corporation to light, and temporary plant for the purpose was fixed at the gas-works; making No. 2 station. In 1888, the Electric Lighting Act Amendment Act became law; and, as the powers of the Corporation became exhausted, it was considered desirable they should avail themselves of its provisions to enable them to make extensions. For this purpose Mr. Chew prepared three schemes, embracing both public and private supply; and the Corporation obtained an Order in the session of 1890. By it the Committee were relieved of the responsibility of carrying it out; the duty being relegated to a new Committee, who have still the matter under consideration. Having given this *résumé* of the operations of the Corporation up to the present time, Mr. Chew glances at the progress made in the electrical world in general, and compares the price of gas and electricity at Blackpool. With gas at 2s. 6d. per 1000 cubic feet, and electricity at 8d. per unit, the ratio for equal lights stands as follows: Gas, 2d.; electricity, 8d. With regard to working expenses, last year they exceeded the original estimate by £200. This was caused by the continuation of the light all the year round, instead of during the season only. Reckoned at per Board of Trade unit, they came to 8·7d.; but this included the maintenance and renewal of poles, lamps, and lanterns—an amount equivalent to 2·22d. per unit. Excluding this, we have 6·48d. per unit as the cost, inclusive of heavy repairs to the boiler and engines. Mr. Chew devotes the end of his report to some remarks on the use of electricity for culinary purposes. Taking the case of boiling a pint of water by gas and by electricity, he shows that with the latter agent the cost would be 0·42d., while with the former it would be 0·015d.—the ratio being 30 : 1 in favour of gas. In conclusion, he points out that the efficiency of the present plant cannot be expected to be maintained, and be equal to that of more modern make, after more than twelve years' working.

THE PURCHASE OF THE IPSWICH WATER-WORKS BY THE CORPORATION.

The Financial Arrangements.

At a Special Meeting of the Ipswich Corporation last Wednesday, the Mayor (Mr. D. Ford Goddard), as Chairman of the Water Committee, presented an important report with reference to the proposed purchase of the water-works. After congratulating the Council upon the fact that the Bill had passed both Houses of Parliament, and was now only awaiting the Royal Assent, the report proceeded: "For the purpose of acquiring the undertaking of the Company, and for defraying the costs and expenses incident to such acquisition (other than the costs of the Act), and for the general purposes of the undertaking, the Corporation are empowered to borrow the sum of £230,000; and with the approval of the Local Government Board, they may also borrow such further moneys as may from time to time be necessary for the purposes of the water-works. They may also borrow such sums as may be requisite to pay for the stock-in-trade, &c., which are by the terms of the contract to be taken by valuation. Money borrowed for the purpose of paying the amount of the valuation is to be repaid within 15 years, and the £230,000 within 60 years from the date of borrowing. The Act empowers the Corporation to raise any amounts which they may hereafter from time to time be authorized to borrow (whether for the purposes of the Act or other purposes) either by mortgage or by the issue of Corporation stock; and it contains all the necessary financial provisions. In submitting the question of the purchase of the water-works to the Council in December last, the Mayor based his calculations upon the money being borrowed at 3¼ per cent. interest. Preliminary negotiations have passed between your Committee and several leading banking firms, which fully justify your Committee in concluding that the amount required can be borrowed at a rate not exceeding 3¼ per cent." The Mayor, in the course of his remarks, said they would have to borrow for the purchase of the undertaking £200,000. There would be bankers' commission and stamp duty, which he put at £4000. The valuation of the stock-in-trade amounted to £1500; and there would be, in addition, the cost of obtaining the Act. They had already paid about £400 of this through the rates; and he was very much in hope that they would not have to include any portion of the cost in the loan, but would be able to discharge it altogether out of current account. The total of the various sums he had mentioned was £205,000; and the interest on that amount at 3¼ per cent. would be £6679. The income which he thought he was right in estimating, for the year commencing in September, 1892, and ending in September, 1893, would be £7400. This was what he believed the water-works would make this year; so that he was adding no increase next year for the growth of the town, and his estimate, therefore, could hardly be excessive. A rate of 1⅓d. in the pound would bring in £1095; making £8495 to meet the liability of £6679. In other words, they would end the first year with a balance in hand of £1816. The Mayor proceeded to carry his calculations on to the year 1895-6, and concluded by moving a resolution empowering the Committee to complete arrangements for the issue of the necessary stock upon such terms as they might find most advantageous to the Corporation, within the limit of 3¼ per cent. interest. Mr. Ridley seconded the motion, which, after a short discussion, was carried—the words "within the limit" being deleted, so as to give the Committee full discretion.

ASHTON-UNDER-LYNE DISTRICT WATER SUPPLY.

One of the principal Water Bills of the present session is that promoted by the Joint Water Committee of the Local Authorities of Ashton-under-Lyne, Stalybridge, and Dukinfield, for the purpose of obtaining an extension of the period for the completion of water-works in the Greenfield and Chew Valleys, at Saddleworth. Owing to the pressure on our space, it has not been possible to record the proceedings on this Bill, which has already passed the House of Lords, and recently came before the Chairman of Ways and Means as an unopposed measure; and therefore the following particulars, which were officially communicated to a local contemporary, may be of interest:—

In addition to the extension of time for the construction of the work sin the Greenfield and Chew Valleys, the Joint Water Committee sought for various other powers relating generally to their undertaking. The time

originally asked by the Committee was for an extension of 10 years to complete the Greenfield reservoir, and 15 years to finish the Chew reservoir. At the suggestion of the Chairman of Committees in the House of Lords, the period for the construction of the Greenfield reservoir was reduced to eight years; but in other respects the Bill passed practically as it was introduced by the promoters. A petition was presented in the Lords by the Saddleworth Guardians, acting as a Rural Authority; but they withdrew it at the last moment. When the Bill came down to the House of Commons, it was opposed by both the Saddleworth Guardians and certain owners and ratepayers in Saddleworth, as well as by the County Council for the West Riding of York. Petitions were presented by them against the Bill. Considerable negotiation took place between the Joint Committee and their opponents, and the Committee from time to time made various offers to the Guardians, which, however, were not accepted. Ultimately a conference took place between the parties in London, on the invitation of the Law and Parliamentary Committee of the West Riding County Council, when the promoters were met by the County Council in a far more reasonable manner than they had been by the Saddleworth people; and ultimately terms of settlement were arranged, under which the opponents agreed to withdraw their petitions. These terms practically amount to this: The Joint Committee agree to lay a special pipe from the watercourse connected with the Yeoman Hey reservoir to a point near the Clarence Hotel, Greenfield, in order to improve the supply of water to the Uppermill and Delph district. To do this will cost about £1000; but it is really a part of the work that would in any case have had to be executed when the new Greenfield reservoir was constructed. The whole effect of the opposition which the Joint Committee have had to encounter is consequently to have caused them to incur an expenditure of £1000 a year or two earlier than they otherwise would have had to do. The Joint Committee were prepared, and actually offered, to give to the Saddleworth people far more advantages than those above mentioned; but they were refused. It is the intention of the Joint Committee, and has been all along, to proceed with the construction of the new Greenfield reservoir at an early date; as it will be shortly required for the needs of the whole district of supply. Moreover the Engineers have reported in favour of its construction. In addition to getting an extension of time, the Joint Committee have obtained some very useful powers; amongst others, power to exchange and sell lands, and to purchase by agreement an additional quantity of 100 acres of land for the protection of their water-works undertakings from contamination. They have also secured the insertion of a new and useful clause, providing that, where an owner of a house under the value of £10 is liable by law to pay water-rent, and fails to do so, the tenant may pay it, and deduct the amount from the rent due or to become due to his landlord. There are other powers enabling the Joint Committee, if they think fit, to insist on cisterns being used in cases where there are baths or water-closets. When the Bill was before Mr. Courtney, he only made a few verbal alterations in it; and it was then passed.

Extension of the Water Distribution System at St. Helens.—The Local Government Board have sanctioned an expenditure of £2100 for the extension of the water-supply mains at St. Helens.

The Lamp Manufacturing Company, Limited, of Leonard Street, City Road, have carried out, under the personal superintendence of Mr. Imre Kiralfy, the lighting of the new Venetian Palace Gardens which have just been added to Olympia.

The Gas Workers' Union and the Eight-Hour Day.—At the opening of the proceedings at the third annual conference of the Gas Workers' and General Labourers' Union, which, as stated in the JOURNAL last week, was then being held in Plymouth, the General Secretary (Mr. W. Thorne) read his report, which contained the recommendation that, as the members were entering upon one of those periods of depression in trade with which workers were well acquainted, they should be very judicious in all their movements in treating with employers on matters connected with work and wages, and that, whenever possible without loss of dignity and self-respect, all disputes should be settled in the most quiet and expedient manner. The report also alluded to the fact of the Union being the pioneer of the eight-hour movement, and stated that most of the members were in favour of some legal enactment on the point, as the only way of permanently securing it. The report was adopted.

Batley Corporation Gas Supply.—At the last meeting of the Batley Town Council, the Mayor (Mr. Alderman Brooke) submitted the Gas Committee's minutes for confirmation. In doing so, he drew attention to the satisfactory character of the balance-sheet for the year ending the 25th of March last, which, he said, had been approved. The report from which he quoted showed that the gross profits in the Gas Department for the period mentioned amounted to £10,712; and that, after paying interest and sinking fund charges, &c., there remained a net profit of £4891. Out of this there had been paid, by the approval and sanction of the Council, a sum of £1438 in aid of the debit balance for the district fund account at March 25, 1891. The Committee had also handed over £2000 during the year in aid of the rates, which left a balance of £1453 carried to the contingency fund. From this fund they had paid on account of capital during the last twelve months £1504, which included an item of about £800 for a new washer. The Mayor explained that they were not increasing the capital account, but that anything expended on this account was paid out of the contingency fund. The figures in the balance-sheet had been gone through very carefully; and the Committee were well satisfied with the year's working, especially taking into consideration the fact that the price of gas had been reduced 5d. per 1000 cubic feet, which made a difference of £2046 in the net profits; while in regard to discounts another £292 would have been added—bringing up the net profits to £7223. All things considered, the Council had every reason, he thought, to be satisfied with their Manager (Mr. J. F. Bromley), seeing that when he took charge of the works the average cost of coal was 3s. per ton less than at the present time, and the stokers' wages were 6d. per shift lower. The year's working was in every way satisfactory, and each member of the Corporation had cause to be thankful. The minutes were confirmed.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Bailie M'Kenzie, the Convener of the Gas Committee of the Aberdeen Corporation, has made a show of resigning the convenership, which I presume he will soon see to be a mistake, as it is founded upon too close a consideration for local and sectional opinion, and does not take into account any question as to the position of the gas industry generally. His letter of resignation, which was laid before the Town Council on Monday, stated that he took the step he did "in consequence of an expression of opinion on the part of a majority of the members of the Gas Committee in favour of keeping the gas at the same illuminating power as last year, or lower." He explained to the Council that a year ago they contracted for coal to furnish gas of 24·53-candle power, but had only had gas of an average of 22·80-candle power; and that his view was that they should raise the illuminating power. Accordingly, before the Committee proceeded to open the tenders for coal which had been sent in, he asked them to decide what the illuminating power of the gas they were to supply this year should be. A majority of the members were satisfied with the gas as it had been; and he, feeling that he could not take any part in the purchase of coal to produce a lower quality of gas, could not remain longer Convener of the Committee. They had not been able, he said, to understand the reason for the difference in the illuminating power. Mr. A. Smith, the Gas Manager, told them that Dr. Hay, the City Analyst, did not give a proper report on the gas; but he had himself been present when Dr. Hay was testing the gas, and, so far as he could see, this was done in a fair and upright manner. Mr. Smith had not concealed that his object was to keep down the illuminating power of the gas, in order that it might suit the users of gas-engines and produce more coke. He held that the community required better gas, and that it was the duty of the Corporation to supply them with what they wanted; that the supplying of gas was their first duty, and that afterwards they should consider the question of the bye-products. There was a long discussion upon the subject of the resignation, which, despite the efforts of the Lord Provost to confine it to the question before them, continually ran on to the merits of higher or lower power gas. Ultimately, the Council, by a majority, adopted a proposal by the Lord Provost to allow the Convener's letter to lie upon the table; and Bailie M'Kenzie agreed to remain at his post until the Manager's report upon the quality of the coal offered should come up for consideration. Now, nothing can be said against, but a great deal for, the position taken up by Bailie M'Kenzie. Corporation owners of gas-works are bound to supply the article which the community desires, even more than companies are. It is also true that a high illuminating power is better than a low one. But the Bailie, in adopting the above truisms as his bulwarks, failed to take two very important considerations into account. He said that last winter "there was very great commotion throughout the town" because the gas was of only 22-candle power; and that he believed the people of Aberdeen wanted better gas. He evidently mistakes the outcry of the better classes, and of the grumblers of all classes, for the voice of the people. We have seen elsewhere the moneyed classes clamouring for better gas, and calling out that they did not mind the cost; and then, when the price was necessarily raised, turning round and saying that, because gas was so dear, they would adopt another light. A gas committee must make its garment out of the cloth it finds in the market; and if the community are dissatisfied, they must be educated in the use of that which is appropriate. This brings forward the second thing which Bailie M'Kenzie forgot—that the general situation is found to be that the higher qualities of gas must be given up. If he would take the advice of Mr. Smith upon this point, he would learn that the richer cannel coals are within measurable distance of being exhausted; and, though they can still be got, the price is such that gas produced from them must be sold at an almost prohibitive rate as far as the poorer classes are concerned. It is the duty of the Corporation to supply gas at a price which will, on the one hand, compete with the cheap illuminant oil in the dwellings of the poor; and, on the other hand, while furnishing a satisfactory light for the better classes, will bring home to them that there is a financial advantage in using it in preference to electric lighting. As to the low illuminating power of the gas obtained from the coal which they purchased last year, that is a matter rather for inquiry than for the resignation of the Convener.

The meeting of the Motherwell Police Commission on Tuesday of this week furnishes material for reflection in more ways than one. The Committee which had been appointed to consider whether they should acquire the undertaking of the local Gas Company, gave in their report, in which they stated that they could not see their way to recommend that any offer be made to the Gas Company, but suggested that the Committee should be continued to watch the development of electric lighting and to bring the subject up again when they deemed that the time was ripe. The spirit in which this recommendation was made was well characterized by a speaker when he said "the Committee was appointed to ascertain terms for taking over the gas-works; and it had ended in the Convener becoming an enthusiast for electricity." I am afraid the Committee's meaning must be found by reading between the lines. They are really of opinion that it would be profitable for the burgh to acquire the gas undertaking. But there is little hope of their being able to do so at present; and they wish to hold over the head of the Gas Company the terror of electric lighting, in the expectation that, if it should move a little forward, the Corporation would be able to "put the screw" on the Gas Company and take them over at a low price.

The Barrhead Gaslight Company is one of the best conducted gas companies in Scotland, thanks to the careful management of Mr. J. Carmichael. The shareholders held their annual meeting on Tuesday; and received the gratifying report that the profit for the year admitted of the payment of a dividend at the rate of 7½ per cent., after allowing 2½ per cent. for depreciation. The Company is not a large one; but good work done in a small way is equally creditable with that which is done on a large scale. The profits for the year were £1159, to which was added £350 brought forward; and the sum carried forward this year is £417. The Chairman complimented Mr. Carmichael

on his very efficient management, which was shown by the fact that, notwithstanding dearer coal and lower prices for residuals, he had been able to produce so satisfactory a result. It is pleasing to observe that Mr. Carmichael's reward did not stop short of compliments; but that it was carried into reality by the unanimous resolution to increase his salary by £20 a year. The recognition of merit always pays; and the shareholders of the Company may rest assured that this increase of salary to their Manager will be a good investment.

In connection with the extensions which are in progress at the Dundee Corporation Gas-Works, Messrs. C. and W. Walker have secured the contract for the supplying of sulphate plant; and Messrs. Whyte and Cooper, the contract for supplying exhausters.

The estimates of the Dundee Gas Commission for the year that is now current have been made np. They show an expected output of 505 million cubic feet of gas, or 15 million cubic feet more than was estimated for last year. Of that quantity, it is expected that 5,600,000 cubic feet will be consumed in the works, and that 50½ million cubic feet will be unaccounted for; which will leave 448,900,000 cubic feet for sale. The gas sold in the year which has just closed amounted to 448,245,950 cubic feet; there was consumed in the works 5,633,100 cubic feet, and there was unaccounted for 50,899,550 cubic feet; so that the estimates show little divergence from what was actually realized last year. The estimate is a very moderate one, when the large increases of the past few years are taken into account. Two things may possibly have moved the Commissioners to a policy of caution—that they are about to advance the price of gas by 1d. per 1000 cubic feet, and that during a portion of this year the Commissioners' electric lighting station will in all probability be in operation. It is well to move cautiously, and certainly it is far better to under-estimate than to over-estimate income; but I think that neither of the above reasons need have influenced the Commissioners very much. Two years ago they had the very large increase of 40 million cubic feet in their output, in face of a rise of 2d. per 1000 cubic feet in price. Last year the output exceeded the estimate by nearly 15 million cubic feet; but it has to be borne in mind that the 15 millions was an increase upon a very much advanced estimate. A better way to look at the matter is that in 1889-90, the output of gas was 387,716,000 cubic feet; which, compared with last year, shows an increased output, in three years, of 117 million cubic feet, or an average of 39 million cubic feet a year. Surely an output which has come forward with such leaps and bounds will not be checked now by a rise of 1d. per 1000 cubic feet. As for the electric light, its adoption is altogether a matter for speculation; but if the experience of Dundee be like that of other places, it will not affect the gas industry at all. The revenue from gas and meter rents for the past year was £81,084; which is £1488 over the estimate, and £4500 over the amount realized in the previous year. The estimate for this year is £84,223. Meter-rents are expected to yield £2900—making £87,123 from both sources of revenue; but from that there falls to be deducted £3620 of interest, and £150 is allowed for bad debts, which leaves a revenue of £83,353. The income from residuals, coke, gas-stove rental, &c., is expected to raise the gross income to £93,299. The expenditure is estimated at £93,029; and the apparent surplus is left of £270.

Mr. Foulis, whom the Dunbar Gas Commissioners requested to select a man to succeed Mr. Cuthbert as Gas Manager there, has recommended Mr. John M'Kechnie, of Glasgow. Mr. M'Kechnie has received the appointment; but not without a grumble on the part of some of the Commissioners, who objected to the hurry with which the affair had been carried through, and to the new Manager being paid at the rate of £80 a year, instead of £70, as agreed upon. It was explained that Mr. M'Kechnie was prepared to work with fewer men than Mr. Cuthbert did, and that the £10 extra of salary would be more than saved in that way.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June* 11.

Sulphate of Ammonia.—There has been little passing; and prices hardly indicate any change. Hull and Leith are quoted at £9 15s. Liverpool prices are rather dearer; but the amount of business is scarcely large enough to establish the prices. There is a fair inquiry springing up, however; and as not many parcels are offering, prices will no doubt be maintained. Nitrate is dearer; 8s. being now the lowest price on spot.

LONDON, *June* 11.

Tar Products.—Buyers seem for the most part to think that the bottom has been touched in the values of benzol, and are more eager to buy, both for prompt and forward, than has recently been the case. Sellers, on the other hand, look for an advance; and but little business has been reported forward. Nineties continue to be more inquired for than fifties. Anthracene is still very dull; and there is no improvement apparent in values, either for spot or forward. Pitch keeps in very good demand at from 27s. to 29s. Carbolic acid is lifeless; and there is no change in the value of crystals. Prices: Tar, 10s. to 12s. Pitch, 27s. to 29s. Benzol, 90's, 1s. 9d.; 50's, 1s. 4½d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 3d. Crude benzol naphtha, 30 per cent., 8d. Creosote, 1d. Naphthalene salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 1d.; 70's, 1s. 4d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 10½d.; "B" quality, 7½d.

Sulphate of Ammonia is very quiet, at about last week's prices. Gas liquor (10 oz.) is quoted at 5s. to 6s. 6d.

Sales of Shares.—At a sale by auction at Colchester last Wednesday, five new £20 shares in the *Colchester Gas Company* were sold at £31 5s. each; five £5 fully-paid shares in the *Hadleigh Gas Company, Limited*, at £3 10s. each; and twenty shares in the *Clacton Gas and Water Company*, at £4 4s. each.——Among some miscellaneous shares lately sold by public auction at Leeds were four £2 10s. ordinary shares in the *Churwell Gas Company*, which produced £14 4s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—With the usual stoppage of the collieries throughout this district—extending in the neighbourhood of Manchester over more than the entire week, and in other Lancashire mining centres over at least three or four days—there is necessarily a temporary suspension of business operations in the coal trade here; and there is practically not very much to report. So far as gas coal contracts are concerned, I do not hear of any particularly new feature, except the report that in one or two cases concessions of 3d. to 6d. per ton have been made in special contracts; but generally tenders continue to be based upon the average prices which were obtained last year, and some considerable quantities have been placed on this basis. The Manchester Corporation have settled some of their contracts; and it is stated that a large quantity of gas coal is being supplied from Yorkshire at the price obtained last year. With reference to the remainder of the locomotive fuel contracts, some of the leading firms are determined not to follow the low prices which were accepted by one or two collieries in recent contracts. No doubt this stronger attitude on the part of the coal-owners is due to the fact that there is now little or no prospect of any interference with wages during the present year; and they do not see how they can supply coal at any lower figures, unless they have some corresponding reduction in wages. With regard to other descriptions of round coal, there is so little buying just now that prices are scarcely more than nominal. Generally quoted rates are being maintained; but although it is exceptional where there is any actually announced giving way, where competition has to be faced prices are easier, and concessions upon list rates are made here and there to effect sales. This is particularly the case with regard to common round coals, suitable for steam and forge purposes, for which very low figures have been accepted, where anything like quantities have been concerned. At the pit mouth, best Wigan Arley coal averages 12s.; Pemberton four-feet and second qualities of Arley, 10s. to 10s. 6d.; common house-fire coals, 8s. 6d. to 9s.; and steam and forge coals, 7s. 9d. to 8s. 3d., with as low as 7s. 6d. having been taken in one or two instances. The shipping demand is also very indifferent; and 9s. 3d. to 9s. 6d. represents the full average price for good ordinary qualities of steam coal, delivered at the ports on the Mersey. Engine classes of fuel continue generally steady at late rates—burgy averaging 6s. 3d. to 6s. 9d.; the better qualities of slack, 4s. 9d. to 5s. 3d.; and common sorts, 3s. 3d. to 3s. 9d. per ton, at the pit mouth.

Northern Coal Trade.—Work being now resumed generally at the Durham collieries, the tendency of the trade is becoming evident. The output of coal is far from being so large as it was before the strike; but it is quite enough to bring down the prices that have been current for three months. Best Northumbrian steam coals may now be quoted 10s. 6d. to 10s. 9d. per ton, f.o.b., and second qualities about 1s. per ton less; but the belief prevails that in a week or two the prices may be lower, as some of the contracts are worked off. Gas coals are rather irregular in price; the contracts of some collieries taking up their diminished output, whilst others have a fair quantity to spare. At present, the range of prices quoted for prompt delivery of good gas coals is from 8s. 9d. to 10s.; but lower prices are looked upon as tolerably certain, for the output will increase considerably after the end of this month—though, of course, the consumption will then begin to tend upwards also. Bunker coals are also lower in price; and from 8s. 6d. to 9s. 3d. per ton f.o.b. is the current quotation, though there are some collieries asking higher prices. Household coals are very dull. Manufacturing coals are quiet. Coke is now in supply from the Durham ovens; and for best blast-furnace coke, about 17s. to 18s. per ton f.o.b. is the rate, but lower prices are soon anticipated. Gas coke is not so plentiful now; the production being very limited, and the stocks having been of late much reduced. The price is unaltered this week.

Scotch Coal Trade.—While activity is still the characteristic of the coal trade, the business continues to be confined to orders for prompt delivery, chiefly for shipping. For forward delivery, buyers are disposed to demand easier prices, on the reliance of Durham coal coming into the market; but against that, coalowners place the fact that six or seven weeks must elapse before the markets can be affected by North of England coal, and that by that time the holidays will be over, and the winter demand will have set in, which will keep up prices. There has consequently, as yet, been no tendency on the part of prices to recede, but rather, for some descriptions, to advance. This is accounted for by the desire on the part of coalmasters to accumulate stocks. They are encouraged in this policy by the fact that the miners are working steadily—which they always do before the holidays—and by the consideration that the holidays this year will probably be more protracted than usual, as no miner will work while a General Election is going on. There has been no advance in the price of gas coal. The rates quoted are: Main, 7s. 9d.; ell, 8s. 6d. to 8s. 9d.; splint, 8s. 3d.; and steam, 10s. to 10s. 3d. per ton. Exports again show a phenomenal increase. For the week they amounted to 191,915 tons; which was 11,072 tons over the previous week; and 67,671 tons more than the corresponding week of last year. The figures for the previous highest week on record were 186,324 tons. For the year to date the total exports have been 3,034,925 tons; an increase over the same period of last year of 421,537 tons.

Gas Workers' Union Officials in Trouble.—Last Sunday evening, William Millman, Assistant Secretary of the Gas Workers' and General Labourers' Union, and William John Anderson, a prominent labour representative, were arrested by the Plymouth police for attempting to hold an open-air meeting in connection with the conference of the Union, in the Bull Ring, on the Hoe, in contravention of the bye-laws of the borough. Application had previously been made for permission to hold meetings; but it was refused. Millman and Anderson were bailed out by a member of the Town Council; and it was understood that they would be brought before the Magistrates yesterday.

Messrs. D. M. Nelson and Sons, late of St. Vincent Street, Glasgow, have removed their offices to No. 68, Bath Street, Glasgow.

The Blackburn Town Council and Electric Lighting.—A Sub-Committee of the Gas Committee of the Blackburn Corporation have had under consideration the best means of utilizing their Electric Lighting Order. To assist them in their deliberations, they issued a circular to occupiers of premises in the centre of the town, to ascertain the probable number of consumers. The favourable replies received were somewhat disappointing to them; but they are of opinion that this result by no means represents the demand if an installation was undertaken. The Sub-Committee also think it would be unwise to allow an electric lighting company to come into the town; so that a move must be made in the matter within the time limited by the Provisional Order—viz., Aug. 4 next. They therefore recommend the Gas Committee to cause "something to be done forthwith."

The Proposed Purchase of the Accrington Gas and Water Works by the Corporation.—We understand that the purchase of the Accrington Gas and Water Company's undertaking by the Corporation is all but an accomplished fact. Terms of purchase have been agreed upon between the Committee of the Town Council and the Directors of the Company; and all that is necessary now is the ratification by the ratepayers and shareholders, and the consent of Parliament. The purchase-money agreed upon is £713,000, made up thus: Annuities equal to maximum dividends, *plus* 10 per cent., which capitalized at 30 years' purchase is equivalent to a sum of £704,000; and compensation to officers and Company's expenses, £9000. Our local correspondent says it is not anticipated that there will be any objection to the scheme from the Accrington people; but the outside districts supplied by the Company may object if the terms do not suit them.

Excursion of Employees of the Glasgow Corporation Gas-Works.—The annual excursion of the employees of the Glasgow Corporation Gas-Works (Dawsholm and Temple stations) took place last Wednesday, when the party, numbering upwards of 600, left Maryhill by special train for Portobello, arriving there at 10.30 a.m. Having dispersed till half-past two, the company again gathered at Joppa Park, where they were met by Mr. and Mrs. Langlands. Here an interesting programme of sports was carried out, during the course of which Mr. A. Wilson (Manager of the above-named stations) announced that Mr. Langlands had intimated his intention of presenting a silver challenge cup to be held annually by the winning team in the tug of war. The events were all well and evenly contested; and at the conclusion the prizes were presented to the successful competitors by Mrs. Wilson. The weather throughout was all that could be desired; and the excursion was thoroughly enjoyed.

Philadelphia Water Supply.—The Philadelphia water supply has been recently reported upon by the Director of the works (Mr. Windrim). He says the Roxborough reservoir, of 148,000,000 gallons capacity, will be finished this year. The city should have reservoirs to contain 10 days' supply; and accordingly additions to the storeage capacity are recommended. At present there are the following reservoirs: East Park, 673,874,000 gallons; Wentz Farm, 36,046,000 gallons; Roxborough, 12,838,000 gallons (which will be increased by the new reservoir to 160,838,000 gallons); Belmont, 40,000 gallons; Fairmount, 26,351,000 gallons; Spring Garden, 12,010,000 gallons; Corinthian Avenue, 37,314,000 gallons; Lehigh Avenue, 26,394,000 gallons; and Mount Airy, 4,546,000 gallons. The total capacity probably exceeds 850,000,000 gallons, as the above figures are only approximations. These reservoirs and their distributing mains are so arranged that all sections of the city except three are plentifully supplied. To meet the requirements of the three partially-supplied sections, Mr. Windrim recommends the construction of additional filtering plant, at least two new reservoirs, and increased pumping plant.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

For Stock Market Intelligence, see ante, p. 1114.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	16½—17½	..	6 0 0
100,000	10	,,	7½	Do. 7 p. c	10	11—12	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 5
100,000	20	27 May	8	Bahia, Limited	20	10—12*	..	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6¼—6⅝	..	5 11 1
40,000	5	,,	7½	Do. New	4	4⅓—5	..	6 0 0
380,000	Stck.	26 Feb.	12½	Brentford Consolidated	100	212—217	..	5 12 11
150,000	,,	,,	9½	Do. New	100	162—167	..	5 10 9
220,000	20	11 Mar.	11½	Brighton & Hove Original	20	40—42	..	5 9 6
888,500	Stck.	11 Mar.	5	Bristol	100	95—100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	42—44	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	15—16	..	5 6 3
328,750	10	—	—	Buenos Ayres (New) Limited	10	6½—7½	..	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	94—97	..	6 3 9
150,000	20	26 Feb.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	13 Apr.	13	Commercial, Old Stock	100	229—234	..	5 11 1
165,000	,,	,,	10	Do. New do.	100	180—185	−2½	5 8 1
130,000	,,	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118—123	..	3 13 2
800,000	Stck.	30 Dec.	13	Continental Union, Limited	100	220—225	..	5 15 6
200,000	,,	,,	10	Do. 7 p. c. Pref	100	190—195	..	5 2 7
75,000	Stck.	30 Mar.	10	Crystal Palace District	100	185—195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19—20	..	5 0 0
354,060	10	,,	10	Do. Partly paid	7½	13½—14½	..	5 3 11
5,470,820	Stck.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	208—212	+1	5 13 2
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	94—98	..	4 1 7
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	250—255	..	3 18 5
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	118—123	..	4 1 3
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	169—174	..	4 6 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	154—158	..	4 8 7
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	247—252	..	3 19 5
476,000	,,	,,	—	Do. K, 6 p. c. Prf.	100	148—153	..	3 18 5
1,061,150	,,	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	114—117	..	3 8 5
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	118—123	..	3 13 2
908,000	,,	,,	6	Do. 6 p. c. do	100	165—169	..	3 11 0
3,800,000	Stck.	12 May	12	Imperial Continental	100	211—215	−1	5 11 8
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4—4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5p. c. Deb.	100	108—110	..	4 10 11
541,920	20	27 Nov.	5†	Monte Video, Limited	20	14½—15½	..	6 9 0
150,000	5	27 May	10	Oriental, Limited	5	7½—8½*	..	6 1 2
60,000	5	30 Mar.	7	Ottoman, Limited	5	4—5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2—3	..	—
				People's Gas of Chicago—				
420,000	100	3 May	6	1st Mtg. Bds.	100	106—110	+2½	5 9 1
500,000	100	1 June	6	2nd Do.	100	100-103*	..	5 16 7
150,000	10	15 Oct.	10	San Paulo, Limited	10	8—9	..	—
500,000	Stck.	26 Feb.	15½	South Metropolitan, A Stock	100	265—270	−5	5 14 10
1,350,000	,,	,,	12	Do. B do.	100	217—221	..	5 8 7
200,000	,,	,,	13	Do. C do.	100	230—240	..	5 8 4
725,000	,,	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	142—146	..	3 8 6
60,000	Stck.	11 Mar.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
729,331	Stck.	30 Dec.	10	Chelsea, Ordinary	100	252—257	..	3 17 9
1,720,252	Stck.	13 Apr.	8	East London, Ordinary	100	195—200	−2	4 0 0
544,440	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	138—142	..	3 3 4
700,000	50	11 Dec.	8½†	Grand Junction	50	99—103	..	4 2 6
708,000	Stck.	12 Feb.	10½	Kent	100	260—265	..	3 19 3
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	222—226	+1½	4 4 0
406,200	100	,,	7½	Do. 7½ p. c. max.	100	188—193	+1	3 17 9
279,700	Stck.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	121—124	..	3 4 6
300,000	100	12 Feb.	12½	New River, New Shares	100	325—335	..	3 12 4
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk	100	126—129	..	3 2 0
902,300	Stck.	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	148—153	..	4 4 11
126,500	100	,,	6½	Do. D 7½ p. c. do.	100	133—138	..	4 14 3
1,155,066	Stck.	11 Dec.	10	West Middlesex	100	242—246	..	4 1 3

*Ex div.

† Next dividend will be at this rate.

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NO OTHER MAKE CAN DO THIS.

Makers of GAS-VALVES HYDRAULIC REGULATORS, VACUUM GOVERNORS STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent.
Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
City Address: 182, Gresham House, Old Broad Street, LONDON, E.C.

WINKELMANN'S "Volcanic" Fire CEMENT. (Fire resistance, 4500° Fahr.)
Prices, particulars, and directions for use on application to ANDREW STEPHENSON, 182, Gresham House, Old Broad Street, LONDON, E.C.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH.
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

OXIDE OF IRON FOR GAS PURIFICATION.

JAMES GORDON & Co., Brokers, can offer Cargoes of good quality; also 2500 tons of SPENT OXIDE.
Samples and price on application.
Address Borough Buildings, 7, Rumford Street, LIVERPOOL.

LIQUOR and Tar wanted.
BROTHERTON AND Co., Ammonia and Tar Distillers, LEEDS and WAKEFIELD.

LIQUID FUEL.

TAR Oils, Naphthalene, Oil Residues, Tar, Petroleum, &c. SADLER'S PATENT BURNER is the simplest and most effective. No smoke; no Ashes.
For particulars and price of Burner and Cheap Oils, apply to SADLER AND Co., LIMITED, MIDDLESBROUGH.

SITUATION wanted, by a thorough steady, reliable man, as ENGINE-DRIVER at a Gas or Water Works. First-class references.
Address A. MILNE, Wilnecote, Tamworth.

RETORT SETTER WANTED.

WANTED, an experienced Retort Setter and Bricklayer. Constant situation to a steady Man.
Apply to JOSEPH DAVIS, Engineer and Manager, Gas-Works, GRAVESEND.

WANTED a first-class Fitter for Gas-Works in Brazil, South America. Wages, £18 to £20 per month.
Apply, by letter only, with full particulars, to Mr. ARTHUR F. PHILLIPS, 31, Great George Street, WESTMINSTER, S.W.

WANTED, for a small Gas-Works at Pontardawe (near Swansea), a MAN to take charge of same. One preferred who, besides doing the stoking, can lay Services and fix Meters. Send full particulars.
Address, ROBT. ALEX. BROWNING, Gas-Works, NEATH.

WANTED, the services of a Gentleman who has a connection with Gas-Works to sell GAS COAL and CANNEL. To a really good Salesman a Salary and Commission would be paid.
Address LUX, care of W. H. Everett and Son, Salisbury Square, Fleet Street, LONDON, E.C.

WANTED by a Suburban Gas Company, a GENERAL FOREMAN. He must be a good Carbonizer, and thoroughly understand Engines, Exhausters, &c., and all the general routine of a Gas-Works.
Application, stating age, and if married or not, to be sent to No. 2107, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by July 1, for a country Gas- Works, a smart HANDY MAN, capable of laying Mains and Services, fixing and inspecting Meters, &c. Preference given to a man with a knowledge of Smithing or Retort Setting. A really good opening for the son of a Working Manager, and permanent for a suitable man.
Apply, by letter, stating age and wages required, with testimonials as to experience and steadiness, to No. 2106, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ON SALE — Surplus Main-Laying Appliances:—
One 10-ton JACK, with Rack for drawing Pipes from Sockets.
One 6-ton JACK, do.
Two pair SHEAR-LEGS, Iron PULLEY-BLOCKS, and sundry other Articles.
Apply, by letter, to No. 2105, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON, Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 1145 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 70, Wellington Street, GLASGOW; 58, Fountain Street, MANCHESTER; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

TO INVENTORS AND OTHERS.

PATENTS for Inventions Secured and TRADE MARKS REGISTERED throughout the World. Advice on all matters connected with the above. Handbook gratis on application.
J. C. CHAPMAN, C.E., Chartered Patent Agent, 70, Chancery Lane, LONDON.

MARSDEN LOCAL BOARD.

WANTED, a good second-hand GAS EXHAUSTER, with Valves, Bye-Pass Governor, and all complete.
Price, with full particulars, to
HY. GILL,
Manager.

FOR SALE—A complete Coal Gas Apparatus, in first-rate condition and good working order. Producing capacity, 5 million cubic feet per annum. All modern improvements, and can be seen fixed upon application. *Bonâ fide* reasons given for disposing.
Apply Box 29, Post Office, LINCOLN.

GAS-METERS FOR SALE.

THE Royal Agricultural Hall Company, Limited, Islington, have FOR SALE one 500-LIGHT DRY METER, and one 200-LIGHT DRY METER, which until recently have been used at the Hall, and are in good working order.
Apply to R. VENNER, Secretary, Royal Agricultural Hall Company, Limited, ISLINGTON.

PONTYMISTER GAS-WORKS.

FOR SALE—Ten Ω-shaped Mouth- pieces, 17 in. by 13½ in., with Lugs, Cross-Bars, and T-Screws, Ten 4-inch ASCENSION-PIPES, and Ten 4-inch H-PIPES; also Two lengths of 14-inch diameter HYDRAULIC MAIN, each length 8 ft. 8 in., with Ten 4-inch Dip-Pipes fitted complete.
Prices to be sent to
W. D. JONES,
Manager.
June 2, 1892.

AMMONIACAL LIQUOR.

THE Directors of the Rickmansworth Gaslight and Coke Company, Limited, wish to dispose of about 1000 barrels of AMMONIACAL LIQUOR, now in store at their Works.
Apply to JOHN D. ROPER, Gas-Works, RICKMANSWORTH.

SHIPLEY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shipley Gaslight Company invite TENDERS for the supply of about 15,000 tons of screened GAS COAL, to be delivered free at the Midland or Great Northern Railway Stations, Shipley, or at the Gas-Works, per Leeds and Liverpool Canal, over a period of Twelve months from July 1, 1892.
The Directors reserve to themselves the right to divide the quantity into two or more contracts, and do not bind themselves to accept the lowest or any tender.
Tenders, sealed, and endorsed "Tender for Coal," are to be sent to me on or before Friday, the 24th of June.
JNO. WILCOCK,
Manager.
Gas-Works, Shipley, Yorks.,
June 10, 1892.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.

OLPHERT'S OXIDE.

FINEST Quality of Natural Bog Ore
Apply for particulars to the Sole Agent, Mr. THOS. L. ARCHER, Cathedral Chambers, Half Street, MANCHESTER.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

OXIDE OF IRON. Genuine Natural Bog ORE. QUALITY AND CONDITION GUARANTEED. Any quantity supplied at lowest rates.
D. M. NELSON AND SONS, 68, Bath Street, GLASGOW. Telegraphic Address: "Gas, Glasgow." Depôts throughout England and Scotland.

OIL for the "Wells" or "Lucigen" Lamps.
HARDMAN AND Co., Miles Platting, MANCHESTER.

COZE'S Automatic Apparatus for CHARGING AND DISCHARGING GAS-RETORTS. See Advertisement p. II., centre of JOURNAL.
Inquiries should be addressed to THE AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED, 86-88A, LEADENHALL STREET, E.C.

DRAWINGS, Tracings, Specifications, Quantities, &c., prepared by an experienced Engineering Draughtsman. Plans of Works made, copied, or enlarged. Blue copies made. Illuminated Addresses in first-class style. Writings of all kinds, Engrossments, &c.
Address J. L. FEATHERSTONE, 173, Fentiman Road, LONDON, S.W.

FRIEDRICH LUX, Ludwigshafen am Rhein; and at No. 142, Great Portland Street London, W.
Lux's Gas Regulators for every consumption.
Lux's single-stem Pressure-Gauges.
Lux's Regulator for Gas-Engines.
Lux's Gas-Balance.
Lux's new Gas Regulator for Inverted Lamps and other Apparatus for Gas Lighting, &c.

CITY OF HEREFORD.

THE Gas Management Committee of the Corporation invite TENDERS for the supply of best screened large GAS COAL for One year, from the 1st of August next, to be delivered free at the Gas-Works Siding, Hereford, in such quantities as may be required from time to time.
The estimated quantity required will be from 7000 to 8000 tons.
Full Particulars and printed Forms of Tender may be obtained on application to the undersigned.
Tenders, endorsed "Tender for Gas Coal," are to be sent in, addressed to the Chairman, Gas Management Committee, Mansion House, Hereford, by Saturday, July 2.
The Committee do not bind themselves to accept the lowest or any tender.
By order,
WILLIAM PARLBY,
Gas Engineer and Manager.
Gas-Works, Hereford,
June 9, 1892.

CITY OF HEREFORD.

TO TAR DISTILLERS AND OTHERS.

THE Gas Management Committee of the Corporation invite TENDERS for the surplus TAR produced at their Works for a term of One year from the 1st of July next.
Particulars and printed Form of Tender may be obtained on application to the undersigned.
Tenders, endorsed "Tender for Tar," are to be sent in, addressed to the Chairman of the Gas Management Committee, Mansion House, Hereford, by Saturday, July 2.
The Committee do not bind themselves to accept the highest or any tender.
By order,
WILLIAM PARLBY,
Gas Engineer and Manager.
Gas-Works, Hereford,
June 9, 1892.

TENDERS FOR SCREENED GAS COAL.

THE Directors of the Tamworth Gas- light and Coke Company invite TENDERS from Colliery-Owners, for the supply of 2000 tons of good screened GAS COAL, at per ton of 21 cwt., delivered free at either the London and North-Western Railway, or Midland Stations, at such times, and in such quantities, as may be required.
The contract to commence as from the 1st day of July, 1892, and continue until July 1, 1893.
Tenders, with name of Colliery, Analysis of Coal proposed to be supplied, and endorsed "Tender for Gas Coal," to be sent to me on or before July 1 next (on printed forms, which may be had on application to me).
The Directors do not bind themselves to accept the lowest or any tender.
By order,
WILLIAM ARNOLD,
Secretary.
28, George Street, Tamworth,
June 9 1892.

GASHOLDER AND CONDENSERS FOR SALE.

THE Great Yarmouth Gas Company have FOR DISPOSAL a GASHOLDER, with Cast-Iron Tank complete; also a set of CONDENSERS in good condition.

Further particulars can be obtained on application to the Engineer.

BOROUGH OF ILKESTON.

THE Gas Committee are prepared to receive TENDERS for the supply and delivery of 5000 tons of GAS COAL.

Conditions and Form of Tender may be had of the Manager (Mr. F. C. Humphrys), the Gas-Works, Rutland Street, Ilkeston.

Sealed endorsed tenders must be delivered to the undersigned by Twelve o'clock at Noon, on Thursday, the 23rd day of June, 1892.

The Committee do not bind themselves to accept the lowest or any tender; and they reserve to themselves the right to divide the quantity above named into two or more contracts.

By order,
WRIGHT LISSETT,
Town Clerk.

Town Hall, Ilkeston,
June 9, 1892.

CORPORATION OF LANCASTER.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL AND CANNEL.

THE Gas Committee are prepared to receive TENDERS for the supply of about 11,000 tons of screened GAS COAL and 5000 tons CANNEL per annum, delivered on the Gas-Works Siding, Lancaster, in such quantities and at such times as may be required during a period of One, Two, Three, or Five years, commencing delivery Aug. 1 next.

Sealed tenders, endorsed "Gas Coal," giving full particulars of the Coal offered, must be sent to Thom. Swainson, Esq., Town Clerk, Lancaster, on or before the 20th day of June next.

Forms of Tender may be obtained on application to the undersigned.

The lowest or any tender not necessarily accepted.

C. ARMITAGE,
Manager.

Gas-Works, Lancaster,
May 27, 1892.

MALDON GASLIGHT COMPANY, LIMITED.

THE Directors of the above Company are prepared to receive TENDERS for the undermentioned Works.

Plans and Specifications may be seen at the Offices of the Company, Maldon, Essex, or at the Office of the Engineers, Messrs. Stevenson and Burstal, 38, Parliament Street, Westminster, on and after Monday, the 13th of June, from Ten a.m. to Five p.m. (Saturday One p.m.).

Sealed tenders to be sent in by Noon of Monday, the 20th of June, addressed to H. Clarke, Esq., Gas-Works, Maldon, Essex.

Charge for Schedule of Quantities Ten Shillings each contract, to be returned on receipt of *bonâ fide* tender.

CONTRACT No. 1.

Providing and laying CAST-IRON MAIN PIPES and APPENDAGES, and removing and relaying existing Pipes.

CONTRACT No. 2.

ALTERATIONS to existing GAS-WORKS—comprising Condenser, Washer, Purifiers, Connecting-Pipes, Station Meter, and other Works.

STEVENSON AND BURSTAL,
Engineers.

NORTH BIERLEY GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of 8500 tons of best screened GAS COAL for One year, from the 1st day of July next, to be delivered at the Low Moor Station, Lancashire and Yorkshire Railway, and in such weekly quantities as will be required by the Company.

Further particulars may be obtained of the Company's Manager, Mr. Robt. G. Shadbolt.

Sealed tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, to be addressed to the Chairman, Gas Offices, Oakenshaw, near Bradford, and delivered not later than Wednesday the 22nd day of June inst.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered and do not bind themselves to accept the lowest or any tender.

By order,
EPM. SUCKSMITH,
Secretary.

Gas-Works, Oakenshaw,
near Bradford, June 4, 1892.

TAR AND AMMONIA WATER.

THE Directors of the Loughborough Gas Company are prepared to receive TENDERS for the surplus TAR and AMMONIA WATER to be produced at their Works for One year from the 30th of June, 1892.

The estimated quantity will be about 400 tons of Tar, and 900 tons of Ammonia Water.

The Tar and Liquor to be delivered into the Contractor's Boats at the Wharf on the Derby Road, Loughborough.

The strength of the Liquor to be tested by Twaddel's Hydrometer (temperature 60°), and the tender to state the price per ton, commencing at 4° and up to 8°.

The Boats for the removal of the Tar and Ammonia Water to be sent at such times as may be required.

Payments on the 10th of the following month.

Further information may be obtained on application to the undersigned, to whom tenders, in accordance with this advertisement, must be sent not later than the 21st of June next.

The Directors do not bind themselves to accept the highest or any tender.

J. B. BALL, C.E.,
Manager.

Loughborough,
June 2, 1892.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

STAINES AND EGHAM DISTRICT GAS AND COKE COMPANY, LIMITED.

THE Directors of this Company invite TENDERS for the supply and delivery, during the year 1892-93, of 6000 tons of either EAST PONTOP, PELAW MAIN, or HOLMSIDE GAS COALS.

The deliveries to commence after the 1st of November next, and continue during the period ending on the 30th of September following.

The Company's Works are on the Bank of the Thames.

Forms of Tender, giving quantities, may be obtained upon application to the Secretary; and all further information may be obtained from the Manager, Mr. Thomas Webb, at the Works, Egham.

Sealed tenders to be sent to the undersigned on or before the 5th day of July, 1892.

JOHN ANTHONY ENGALL,
Solicitor and Secretary.

Staines, June 9, 1892.

CHELMSFORD GASLIGHT AND COKE COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company invite TENDERS for the supply of GAS COAL for One year, commencing Aug. 1, 1892.

The quantity required is about 3500 tons.

The Coal must be fresh, of the best quality, well screened, free from Bats, Stones, Dust, Pyrites, and all other Impurities.

Sealed Tenders, stating price per ton, delivered free at the Siding of the Great Eastern Railway Company, Chelmsford, or f.o.b. the Company's Ships in the Tyne, endorsed "Tender for Coal," must be sent not later than the 27th of June next.

The Directors reserve to themselves the right to decline the lowest or any tender.

Particulars of monthly deliveries, and any further information, may be had of the undersigned on application.

EDMUND G. SMITHARD,
Engineer.

Gas-Works, Chelmsford,
June 7, 1892.

TIPTON GAS-WORKS.

TAR CONTRACT.

THE Gas Committee of the Tipton Local Board invite TENDERS for the purchase of the surplus TAR produced at the above Works, during a period of One, Two, or Three years, from the 1st of July next.

Particulars may be obtained at the Gas-Works, on application to Mr. Vincent Hughes, the Engineer and Manager.

The Tar may be delivered either into Boats or on Rail (L. & N.W.R.), as may be required.

Sealed and endorsed tenders to be sent to me the undersigned not later than Ten a.m., on Friday the 24th inst.

The Committee do not bind themselves to accept the highest or any tender.

By order,
GEO. M. WARING,
Clerk to the Board.

Public Offices, Tipton,
June 9, 1892.

COUNTY BOROUGH OF BURY.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Gas Committee of the Corporation of Bury are prepared to receive TENDERS for the supply of GAS COAL and CANNEL for One, Two, or Three years, commencing on the 1st day of August next, to be delivered in such quantities as may be required from time to time.

Quantity required, 30,000 tons of Coal and 2000 tons of Cannel per annum.

Full Particulars and Form of Tender may be obtained on application to the Engineer, W. H. S. Gendall, at the Gas-Works, Elton, Bury.

Sealed tenders, endorsed "Tender for Coal and Cannel," to be sent to the undersigned on or before Monday, the 20th of June, 1892.

JOHN HASLAM,
Town Clerk.

Corporation Offices, Bury,
June 8, 1892.

BOROUGH OF BURTON-UPON-TRENT.

RESIDUAL PRODUCTS.

THE Mayor, Aldermen, and Burgesses of the Borough of Burton-upon-Trent, acting by the Council, invite TENDERS for the purchase of the AMMONIACAL LIQUOR and surplus TAR to be produced at their Works during Six months and Twelve months respectively from the end of July next.

Probable quantity of Coal carbonized during the Twelve months, 25,000 tons.

The Liquor and Tar will be delivered free into Contractor's Tank-Trucks on the Gas-Works Railway Siding.

The strength of the Liquor will be tested by Twaddel's Hydrometer; and persons tendering are requested to state the price per ton to be paid for each ½° of strength from 3½° to 8°.

Payments, net cash, monthly.

Separate tenders for Liquor and Tar, sealed, and endorsed "Tender for Residual Products," are to be delivered to me, at or before Ten a.m., on Friday, the 1st of July next.

The highest or any tender will not necessarily be accepted.

F. L. RAMSDEN,
Manager and Engineer.

Gas-Works, Burton-upon-Trent,
June 8, 1892.

TENDERS FOR GAS COAL.

THE Directors of the Malton Gas Company invite TENDERS for the supply of 3000 tons of best screened GAS COAL and NUTS, for One year, commencing the 1st of July next.

Forms of Tender and full Particulars may be obtained on application to the undersigned.

Tenders to be sent in or before the 20th inst.

HENRY TOBEY, Secretary.

Gas-Works, Malton, Yorks.,
June 13, 1892.

THE Hindley Local Board are prepared to receive TENDERS for the purchase of the TAR and AMMONIACAL LIQUOR produced at their Gas-Works during the ensuing Twelve months.

Full Particulars, with Form of Tender, can be obtained on application to Mr. William Dickinson, Gas and Water Manager.

Sealed tenders, endorsed "Tender for Tar, &c.," to be lodged with the undersigned not later than Monday, June 20, 1892.

By order,
STEPHEN HOLT,
Clerk to the Local Board.

Offices: Cross Street, Hindley,
June 1, 1892.

CIRENCESTER GAS COMPANY, LIMITED.

THE Directors are prepared to receive TENDERS for the supply of from 2000 to 3000 tons of best screened GAS COAL, to be delivered during the Twelve months ending the 30th of June, 1893, at the Watermoor Station of the M. & S. W. Junction Railway Company, at such times and in such quantities as the Manager may direct.

Tenders, marked "Tender for Coal," to be sent to the undersigned not later than Thursday, the 30th of June, 1892.

The Directors do not bind themselves to accept the lowest or any tender.

J. P. BEECHAM,
Secretary.

12, Silver Street, Cirencester,
June 11, 1892.

TO IRONFOUNDERS, ETC.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the supply of RETORT-FITTINGS, including Hydraulic Mains, Ascension-Pipes, Buckstaves, &c., for 96 Mouthpieces at their Effingham Street Station.

Form of Tender, with Bill of Quantities, may be obtained, and Drawings can be seen, on application to the Engineer, Mr. Fletcher W. Stevenson, on and after Saturday, the 18th inst.; and sealed tenders must be delivered, addressed to the undersigned, not later than Saturday, July 2, endorsed "Tender for Retort-Fittings."

The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS,
General Manager.

June 11, 1892.

SOWERBY BRIDGE LOCAL BOARD OF HEALTH
(GAS DEPARTMENT.)

THE Gas Committee of the Sowerby Bridge Local Board are prepared to receive TENDERS for the supply of 10,000 tons of best GAS COAL and 1000 tons of CANNEL COAL required in each year, for One, Two, or Three years, from July 1, 1892.

Specifications and Form of Tender can be obtained by applying to the Manager at the Gas-Works.

Tenders to be sent in not later than Monday, June 27, 1892, endorsed "Tender for Coal" or "Cannel," and addressed to the Chairman of the Gas Committee, Gas-Works, Sowerby Bridge.

The Gas Committee do not bind themselves to accept the lowest or any tender.

JOHN MARSLAND,
Engineer and Manager.

Gas-Works, Sowerby Bridge,
June 10, 1892.

GAS COAL AND CANNEL.

THE Gas Committee of the Carnarvon Corporation invite TENDERS for the supply of about 1700 tons (more or less) of good GAS COAL, and about 150 tons (more or less) of CANNEL or CANNEL NUTS, delivered, as required, during the year ending Aug. 31, 1893, free in Trucks at Carnarvon Railway Station (L. & N. W. R.).

Full particulars may be obtained from the undersigned.

Sealed tenders, endorsed "Tender for Coal and Cannel," and addressed to the Chairman of the Gas Committee, Guildhall, Carnarvon, to be delivered on or before Thursday, June 23, 1892.

The Committee do not bind themselves to accept the lowest or any tender.

R. O. WYNNE ROBERTS,
Borough Engineer.

Carnarvon.

SUTTON, SOUTHCOATES, AND DRYPOOL GAS COMPANY, HULL,

INVITE Tenders for the surplus Tar, also for the whole of the AMMONIACAL LIQUOR produced at their Works at per ton over the Company's Machine, from the 1st of July, 1892, to the 30th of June, 1893, both inclusive.

Probable quantity of Tar, 700 tons.

Do. Ammoniacal Liquor, 900 tons.

Both Tar and Ammoniacal Liquor to be taken from the Company's elevated Tank into Contractor's Carts or Casks, which must be supplied as required by the Vendors.

Tenders for Ammoniacal Liquor must state price per degree Twaddel's Hydrometer, from 4° to 8°.

Further particulars may be obtained of the Manager at the Gas-Works, St. Mark's Street.

Tenders to be sent to the undersigned, on or before the 24th of June, 1892, endorsed "Tender for Tar or Liquor."

The Company do not bind themselves to accept the highest or any tender.

DAVID WOOD,
Secretary.

Offices: St. Mark's Street, Hull,
June 10, 1892.

WIRE ROPE & GASHOLDERS.

It is well known that some alterations we designed and carried out for the Manchester Corporation in 1889 have been the subject of an Action for Infringement of Patent Rights.

The Plaintiffs have failed to uphold their contention; the Court deciding **that the use of Ropes did not come within the scope of their claim.**

The design carried out at Manchester was in accordance with a Patent granted to Mr. E. L. Pease; and that the new method of preserving the true level of a Gasholder with Ropes, instead of Columns, is a success, may be gathered from the fact that **the Gasholder at Manchester has worked since 1889 without a moment's attention.**

That Wire Ropes are admirably adapted for use in connection with Gasholders, will be seen by the following considerations.

1. Their use means a great saving, combined with absolute security.
2. The method of working and the nature of the fittings are the simplest possible.
3. Every part is readily accessible.
4. Renders possible the use of very shallow Holders.
5. As all the moving parts act independently, there is no danger in an accident to any one of them.
6. No alteration needed in the construction of the Holder or Tank.
7. Applicable to the Inner Lift alone, or to all Lifts of a multiple lift Holder.
8. Very useful in conjunction with Columns to secure the true working of old Holders.

The large number of Holders working on this system in America and England, and giving complete satisfaction, proves its reliability.

Wire Ropes, when used in conjunction with existing Columns, render it possible to **increase storeage** by means of added Lifts, even when a Holder works badly, because, owing to the way in which the Rope is arranged, it is impossible for any lift of the Holder to get out of level.

We shall be very pleased to supply Drawings and Estimates to meet all requirements.

ASHMORE, BENSON, PEASE, & Co., Limited,

STOCKTON-ON-TEES.

CORPORATION OF DONCASTER.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply of GAS COALS, screened or unscreened (about 18,000 tons per annum), for One, Two, or Three years.

Particulars and Form of Tender can be obtained on application to the Chairman or Engineer.

Tenders, addressed to Alderman Athron, Chairman, endorsed "Tender for Gas Coals," to be delivered at this Office not later than Saturday, the 25th inst.

The Committee do not bind themselves to accept the lowest or any tender.

R. BRIDGE,
Engineer and Manager.

Gas-Works, Doncaster,
June 10, 1892.

THE Directors of the Ystrad Gas and Water Company are prepared to receive TENDERS for the surplus TAR produced at their Gas-Works at Ystrad and Hafod, Rhondda Valley.

Annual production, about 380 tons.

Price to be at per ton of 2240 lbs. in Contractor's Tank-Wagons, at Bodryngallt Siding, Ystrad, and Eirw Branch Siding, Hafod (both on the Taff Vale Railway).

The Directors do not bind themselves to accept the highest or any tender.

Tenders to be delivered to the undersigned not later than Nine a.m., on Wednesday, the 29th inst.

A. P. JAMES,
Secretary.

24, Duke Street, Cardiff.

THE Directors of the Ware Gaslight and Coal and Coke Company, Limited, invite TENDERS for the supply of from 900 to 1200 tons of EAST PONTOP, NEW PELTON, or PELAW MAIN GAS COALS, to be considered at their Meeting to be held on Tuesday, the 21st of June inst.

Full particulars may be obtained on application to me the undersigned at my Office.

Dated this 7th day of June, 1892.

By order of the Board,
GEO. H. GISBY,
Secretary to the Company.

Baldock Street, Ware.

HULL GASLIGHT COMPANY.

TENDERS FOR TAR.

THE Kingston-upon-Hull Gaslight Company invite TENDERS for the surplus TAR for One year, the same to be sent in to the Chairman of the Company on or before the 27th of June, 1892.

Particulars may be obtained from

THOMAS BULL,
Engineer and Manager.

Gas-Works, Broadley Street, Hull.

RADCLIFFE AND PILKINGTON GAS COMPANY.

TO TAR DISTILLERS.

THE Directors of this Company invite TENDERS for the purchase of 700 tons of the surplus TAR now in stock, and to be produced at their Works in Radcliffe during the ensuing year.

Particulars may be obtained from the undersigned, to whom endorsed tenders must be delivered not later than Thursday, the 30th inst.

JAMES BRADDOCK,
Manager and Secretary.

Gas-Works, Radcliffe,
June 7, 1892.

EVESHAM CORPORATION.

(GAS DEPARTMENT.)

THE Gas Committee are prepared to receive TENDERS for the supply of 1000 to 1700 tons of screened GAS COAL, delivered free at Evesham Railway Station, during the Twelve months ending June 30, 1893, at such times and in such quantities as the Manager may direct.

Tenders, specifying the description of the Coal, to be sent to me on or before the 18th of June inst.

THOS. COX,
Town Clerk.

Evesham, June 8, 1892.

LEIGH LOCAL BOARD.

THE Gas Committee of the Leigh Local Board invite TENDERS for the supply of GAS COAL or NUTS for a period of One year, commencing on the 1st of July next.

The quantity required is 8000 tons.

Specification and all particulars may be had from the undersigned.

Sealed tenders, endorsed "Coal," and addressed to Jas. Thorp, Esq., Chairman, to be delivered at the Town Hall, Leigh, not later than Monday, the 20th of June next.

The lowest or any tender not necessarily accepted.

ALFRED T. FLETCHER,
Engineer and Manager.

Gas-Works, Leigh, Lancs.,
June 8, 1892.

CORPORATION OF LEICESTER.

COAL TENDERS.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply of COALS, COBBLES, or NUTS (about 110,000 tons per annum) for One, Two, or Three years, ending May 31.

Particulars and Form of Tender can be obtained on application to the Engineer.

Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Gas Coal," to be delivered at these Offices not later than Eleven o'clock a.m., on Saturday, the 18th of June.

The Committee do not bind themselves to accept the owest or any tender.

ALFRED COLSON, M. Inst. C.E.,
Engineer and Manager.

Gas Offices, Millstone Lane,
Leicester, June 7, 1892.

DUKINFIELD LOCAL BOARD.

TENDERS FOR CANNEL AND COAL.

THE above Board invite Tenders for CANNEL and COAL by Tuesday noon, the 21st inst.

For Specification and Forms of Tender, apply to

HARRISON VEEVERS,
Engineer.

Dukinfield,
June 1, 1892.

BOROUGH OF WARRINGTON.

(GAS DEPARTMENT.)

TO COLLIERY PROPRIETORS.

TENDERS are invited for the supply of 17,000 tons of COAL, and 2000 tons of CANNEL.

Further particulars can be obtained on application to Mr. W. S. Haddock, Engineer to the Department.

Sealed tenders, endorsed "Tender for Coal," and addressed to the Chairman of the Gas Committee, must be sent in not later than Twelve a.m. on the 30th inst.

FREDK. TAYLOR,
Secretary.

Gas Offices, Warrington,
June 10, 1892.

CORPORATION OF LONGTON.

(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for their surplus TAR for the year ending June 30, 1893.

Estimated quantity, about 600 tons.

Tenders to state price per ton for the Tar, which will be delivered into the Contractor's Railway Tanks at Longton Station by the Corporation.

Tenders, properly endorsed, and addressed to the Chairman of the Gas Committee, Gas-Works, Longton, must be delivered on or before Tuesday, the 28th inst.

W. W. HULSE,
Secretary and Manager.

June 10, 1892.

NORTHWICH GAS COMPANY.

TENDERS are invited for the supply and delivery at Northwich Railway Station, of about 3000 tons of GAS COAL during the ensuing Twelve months.

Tenders are also required for the supply and delivery of LIME and SULPHURIC ACID during the same period.

Any further particulars required may be had on application to Mr. Mellor, Manager.

Tenders, endorsed and addressed to the Chairman, must be delivered here not later than Ten a.m. on Saturday, June 25.

HY. PICKERING,
Secretary.

Gas-Works, Northwich,
June 10, 1892.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Newark Gas Company are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works for One year, from the 1st day of July, 1892.

Terms, Cash Monthly.

Further particulars can be obtained on application to the undersigned, to whom sealed tenders are to be sent on or before the 28th inst., marked on the outside "Tender for Tar."

The Directors do not bind themselves to accept the highest or any tender.

By order,
FREDK. B. FOOTTIT,
Secretary.

Newark.

TO GAS COAL OWNERS AND DEALERS.

THE Totnes Gas Company invite TENDERS for the supply of about 1200 tons of best ARLEY, ALDWARKE, DURHAM, or other good GAS COAL.

Price f.o.b. from July 1, 1892, to June 30, 1893; price delivered at Totnes Quay from July 1 to Oct. 31, 1892, and remaining quantity from March 1 to June 30, 1893; accompanied by working analysis as to quantity and quality of Gas and Coke produced.

No tender necessarily accepted.

Tenders to be delivered by the 28th of June, 1892, to the MANAGER, Gas-Works, Totnes, DEVON.

June 8, 1892.

SURPLUS TAR.

THE Gas Committee of the Corporation of Coventry are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works, Coventry, for One year from July next.

Make, about 1500 tons per annum.

Tenders, stating price per ton delivered into Boat, to be addressed to the Manager, marked "Tender for Tar," not later than June 18.

The Committee do not bind themselves to accept the highest or any tender.

GEO. WINSTANLEY, Assoc. M. Inst. C.E.,
Manager.

Gas-Works, Coventry,
June 10, 1892.

BOROUGH OF NELSON.

(GAS DEPARTMENT.)

THE Gas Committee of the above Corporation invite TENDERS for the supply of about 76 tons of 6, 4, and 3 inch CAST-IRON PIPES (with Turned and Bored Joints).

Specification and Form of Tender can be obtained from the Engineer, Mr. Wm. Foster.

Tenders to be endorsed "Tender for Pipes," and addressed to Mr. R. Prescott, Town Hall, Nelson, and sent in on or before Wednesday, the 29th day of June, 1892.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
R. M. PRESCOTT,
Town Clerk.

Town Hall, Nelson,
June 10, 1892.

HYDE GAS COMPANY.

COAL AND CANNEL—TAR AND LIQUOR.

THE Directors of the Hyde Gas Company invite TENDERS for COAL and CANNEL. Also OFFERS for TAR and LIQUOR for One year, ending the 30th of June, 1893.

Particulars may be obtained from the undersigned, at the Gas-Works, Raglan Street, Hyde.

WILLIAM SMITH,
Secretary and Manager.

June 10, 1892.

THE East Dereham Local Board are prepared to receive TENDERS for the supply of about 1200 tons of screened GAS COAL for the ensuing year.

Conditions and Forms of Tender to be had of the undersigned.

Tenders to be sent in by July 4, 1892.

B. H. VORES,
Clerk to the Local Board.

East Dereham,
May 21, 1892.

THE Haworth Local Board of Health are prepared to receive TENDERS for the supply of 1700 tons of unscreened GAS COAL, to be delivered (in such quantities as the Board may determine) on Rails at the Haworth Railway Station within the ensuing Twelve months.

Tenders to be forwarded to me the undersigned, marked "Coal Tender," on or before the 23rd inst.

WM. ROBERTSHAW,
Clerk.

5, Temple Street, Keighley,
June 11, 1892.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Ossett Gas Company are prepared to receive TENDERS for the purchase of the AMMONIACAL LIQUOR and surplus TAR produced at their Works during the Twelve months ending the 30th of June, 1893.

The Liquor to be quoted for both by Twaddel's and Wills's Tests.

Tenders to be sent in not later than Wednesday, the 22nd inst.

By order,
JAS. CASTLE,
Secretary.

Ossett, June 11, 1892.

TENDERS FOR GAS COAL.

THE Directors of the Cheltenham Gaslight and Coke Company are prepared to receive TENDERS for the supply of GAS COAL for One year from the 1st day of August next.

Particulars may be obtained from the undersigned, to whom tenders must be delivered on or before Wednesday, the 22nd of June next.

The Directors do not bind themselves to accept the lowest or any tender.

R. O. PATERSON,
Engineer.

Gas-Works, Cheltenham,
June 10, 1892.

GAS COAL.

TENDERS are invited for the supply of from 2000 to 6000 tons of good GAS COALS, capable of yielding, under average working, 10,500 cubic feet of 15-candle Gas per ton of 20 cwt., and Coke of good quality.

Deliveries to be made in such quantities as may be required during Twelve months from July next.

Quotations to specify if coal is screened or unscreened.

Offers may be sent to me, endorsed "Tender for Gas Coal," during the next Ten days.

FRED. G. DEXTER.
Manager.

Water and Gas Company, Winchester,
June 14, 1892.

LONGWOOD GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works for the ensuing Twelve months, commencing the 1st of July, 1892.

Tenders to be sent, addressed to the Chairman, on or before June 18, 1892, endorsed "Tender for Tar and Ammoniacal Liquor."

The Liquor to be 5° of strength, tested by a standard Twaddel's Hydrometer.

JOHN LOWE MITTON,
Manager and Secretary.

Gas-Works, Longwood, Huddersfield,
June 11, 1892.

EAST LONDON WATER-WORKS COMPANY.

NOTICE is hereby given, that the TRANSFER BOOKS in respect of the DEBENTURE STOCK only will be closed on the 16th of June inst., and re-opened on the 1st day of July, 1892.

I. A. CROOKENDEN,
Secretary.

St. Helen's Place, London, E.C.
June 9, 1892.

HEALTH EXHIBITION, New Drill Hall, Portsmouth, including Sanitary Apparatus and Appliances, Arrangements for Water Supply, Heating and Cooking Apparatus, Electric Lighting, Smoke-Preventing Appliances, Articles relating to Personal Hygiene, Domestic Economy, Foods, Clothing, Life and Labour Saving Appliances, &c., to be held from Sept. 13 to Oct. 8, 1892, in connection with the Autumn Congress of the Sanitary Institute.

Prize Medals and Certificates of Merit will be awarded for approved exhibits.

Forms of Application for Space and all Particulars can be obtained from the Curator, Mr. W. H. Knight 74a, Margaret Street, LONDON, W.

Price: 10*s.* *per* 100; £1 2*s.* 6*d.* *for* 250; £2 *for* 500; £3 15*s.* *per* 1000. *Specimen copy (by post)*, 4*d.*

The Use and Value of

Sulphate of Ammonia as Manure.

BY

WILLIAM ARNOLD, F.S.I.,

Land and Estate Agent; Rating Surveyor and Valuer; Chairman of the Tamworth Gaslight and Coke Company.

LONDON:

WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time labour, and expense.

For particulars, price &c., apply to Mr E. PRICE, Inventor and Patentee, 22, Alwyne Road Canonbury, LONDON, N.

Prices are Reduced.

THOMAS ILLINGWORTH,

NORTH DEAN CHEMICAL WORKS,

Near HALIFAX,

MANUFACTURER OF SULPHURIC ACID

OF EXTRA QUALITY FOR MAKING

WHITE SULPHATE OF AMMONIA.

TAR, LIQUOR, AND SPENT OXIDE Purchased for Cash against Delivery.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London) PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

FIRE-BRICKS.

FIRE-CLAY.

JAMES WHITE & Co., Limited,

Albert Oil-Works,

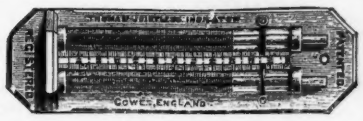
WIDNES, LANCASHIRE,

Sole Proprietors of the Largest and Purest Beds of Fire-Clay in England.

FOR GAS FURNACES our GANNISTER and SILICA FIRE-BRICKS are acknowledged to be the best and most durable in the market.

GANNISTER and SILICA FIRE-CLAY guaranteed of the Purest and Finest Quality.

ANALYSIS AND REFERENCES ON APPLICATION.



THOMAS'S JOINTLESS GAS GAUGES.

COWES, I.W.

ROSEWELL BOGHEAD.

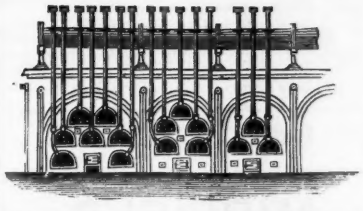
Yield of Gas per ton . . . 13,215 Cub. Ft.
Illuminating Power . . . 37·56 Candles.

GAVIN PAUL & SONS,

CANNEL COALMASTERS,

EDINBURGH.

DEMPSTERS'



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RETORT-FITTINGS,

ELLAND.

THOMAS TURTON

AND SONS, LIMITED,

Sheaf & Spring Works,

SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

London Office:

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T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

AUG. KLÖNNE,

DORTMUND (GERMANY).

REGENERATIVE FURNACES.

Unsurpassed in Efficiency, Economy, Durability, and Easy Working.

COKE BREAKERS.

G. R. Mather & Son, Engineers, Wellingboro'.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE near SHEFFIELD

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY

Strongly recommended where EXCESSIVE HEATS have to be maintained

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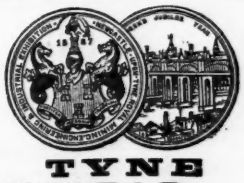
Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.



TYNE BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 70 per cent.

For Prices and complete Analysis, apply to

YOUNG, DANCE, & CO.,

COAL OWNERS, NEWCASTLE-ON-TYNE.

Or E. FOSTER & CO., 21, John St., Adelphi, LONDON, W.C.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
REST GLASSHOUSE POT & CRUCIBLE CLAY.
Shipments Promptly and Carefully Executed.

MEIKLEJOHN'S PATENT
Improved Slide-Valve Anti-Dip.

Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.
Is cheap and easily fixed to any form of main.
Will be found the most efficient appliance of the kind yet introduced.
Further particulars and price from
C. MEIKLEJOHN,
OLDBURY, BIRMINGHAM.
(Late N. Meiklejohn, Longwood.)

CAST-IRON PIPES
FOR GAS AND WATER.
Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.
VALVES
FOR GAS, WATER, AND STEAM
TELEGRAMS: "PIPES GLASGOW."
WM. MACLEOD & CO.,
56, ROBERTSON STREET, GLASGOW.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)
PRESENT production nearly 3000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves 69 per cent. of excellent Coke. During the year 1890, the London Gas Companies carbonized about 400,000 tons of HOLMSIDE COALS. They are used by The Gaslight and Coke Company, the South Metropolitan Gas Company, the Commercial Gas Company, the Woolwich (Government) Gas-Works, the Newcastle and Gateshead Gas Company, the European Gas Company, the Ipswich Gas Company, and by many other Gas Companies both at Home and Abroad.
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, near DEWSBURY.

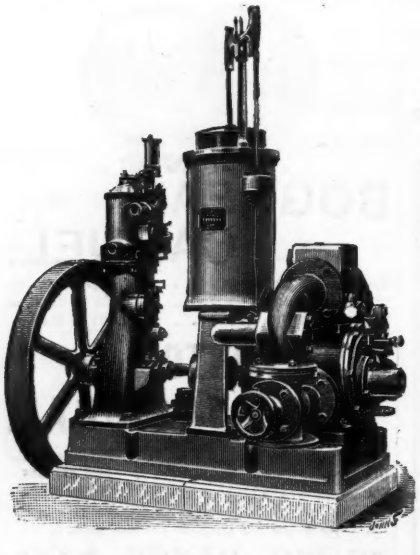
MARKS & RUSSELL,
Cannel and Gas Coal Merchants,
53, WATERLOO STREET,
GLASGOW.

NEWBATTLE CANNEL.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

Lanemark Coal Co.,
LIMITED.
LANEMARK CANNEL AND GAS COALS.
Quotations and Analysis on application to
LANEMARK COLLIERY,
NEW CUMNOCK, N.B.
Shipping Ports: All the principal Scotch Ports.

JOHN BROWN & CO., Ltd., SHEFFIELD,
Proprietors of
ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.
ALDWARKE MAIN GAS COAL
Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
Telegrams: "ATLAS SHEFFIELD."

CAN BE SEEN IN ACTION ON AND AFTER JUNE 13.
(AT ADDRESS BELOW)
WALLER'S PATENT COMBINED GAS ENGINE AND EXHAUSTER
WITH
Disc-Valves, Automatic Bye-Pass Valve, Throttle-Valve, and Regulator,
COMPLETE ON ONE BASE PLATE.
Designed chiefly for sizes from 500 to 15,000 feet per hour.



EXHAUSTERS OF ANY SIZE
COMBINED WITH GAS-ENGINES (now made to vary in speed).
ENGINES & EXHAUSTERS RUN AT DIFFERENT SPEEDS
Waller's Washer-Scrubber with Wood Clusters.
ELEVATING AND CONVEYING MACHINERY FOR COAL, COKE, &c.
G. WALLER & CO.,
58, PARK STREET, SOUTHWARK (SURREY SIDE OF SOUTHWARK BRIDGE).

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND DISTRICT OFFICE: 22, TEMPLE ST., BIRMINGHAM—SOLE AGENT: A. C. SCRIVENER.

TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.

LONDON DISTRICT OFFICE: 6, STRAND, LONDON—C. PARKER & SON, SOLE AGENTS.

TELEGRAPHIC ADDRESS: "PARKER LONDON."

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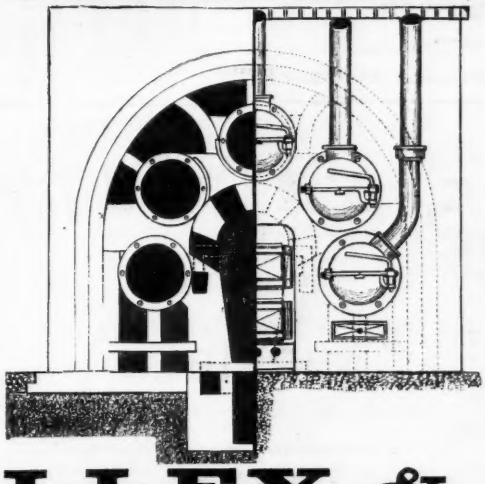
(PROVISIONALLY PATENTED.)

ADVANTAGES.

High Uniform Heats.
Simplicity.
Economy of Fuel.
No Costly Excavation.
No Cutting Heats.
Fifteen per cent. Coke Saved.
Gas Make Increased Fifteen per cent.
Easily adaptable to existing Arches, for Settings of three, four, five, and six Retorts.



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Gasholders and Tanks.
Purifiers and Lifts.
Roofs.
Condensers.
Scrubbers and Washers.
Station Meters and Governors.
Engines and Exhausters.
Retort-Fittings.
Consumers' Wet and Dry Meters, of special excellence.
Gas-Fittings of every description.

WILLEY & Co.,

GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

London Offices: 12, ST. HELEN'S PLACE, E.C.

MORRIS & CUTLER'S PATENT CONDENSER

IN USE AT OVER 70 WORKS.

NOW UNDER CONSTRUCTION FOR

COLCHESTER,
BELFAST,
BRAZIL,
HONG-KONG,
HARROGATE,
MANCHESTER.

CUTLER'S PATENT WATER-VALVES,

ESPECIALLY SUITABLE FOR PURIFIERS.

CUTLER'S PATENT GUIDE-FRAMING,

STRONG, SAFE, CHEAP.

EVERY REQUIREMENT FOR GAS-WORKS SUPPLIED.

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S. CUTLER & SONS,

PROVIDENCE WORKS, MILLWALL, LONDON.

HANNA, DONALD, & WILSON,

(Established 1851),

GAS ENGINEERS & CONTRACTORS,

Abercorn Foundry and Abbey Works,

PAISLEY, N.B.,

MAKERS OF

Gasholders and Gas Plant

OF EVERY DESCRIPTION.

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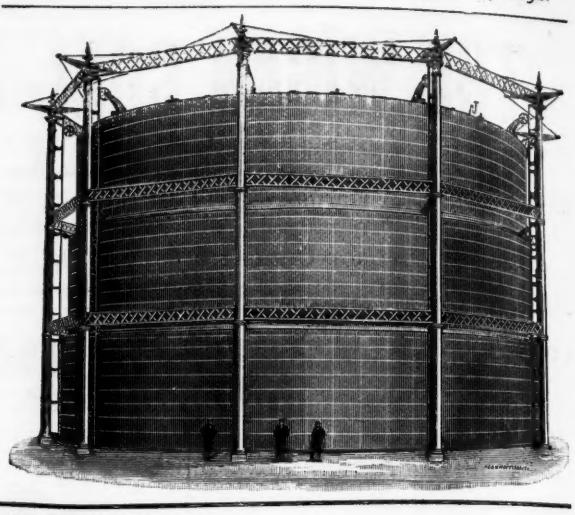

TUBES AND FITTINGS

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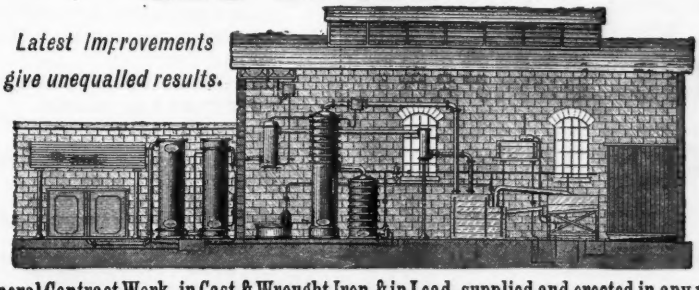

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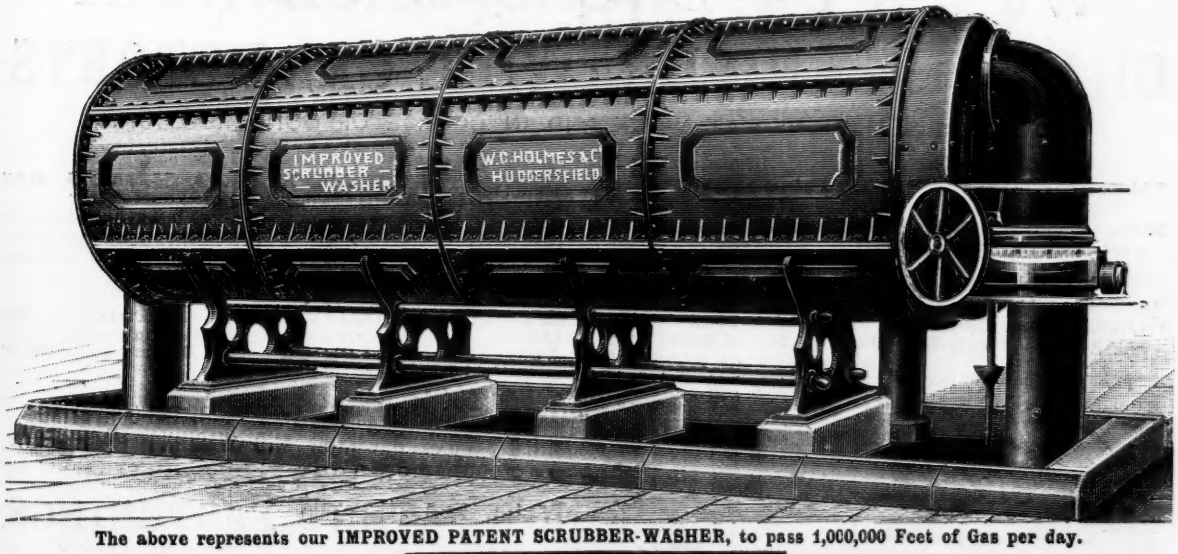

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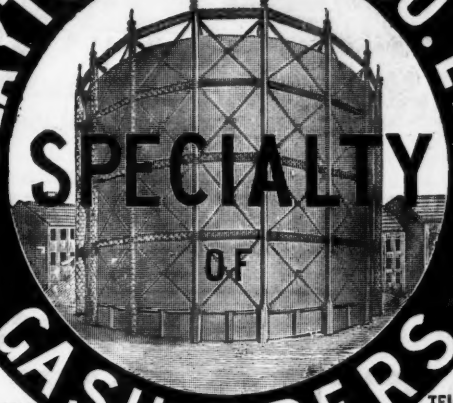

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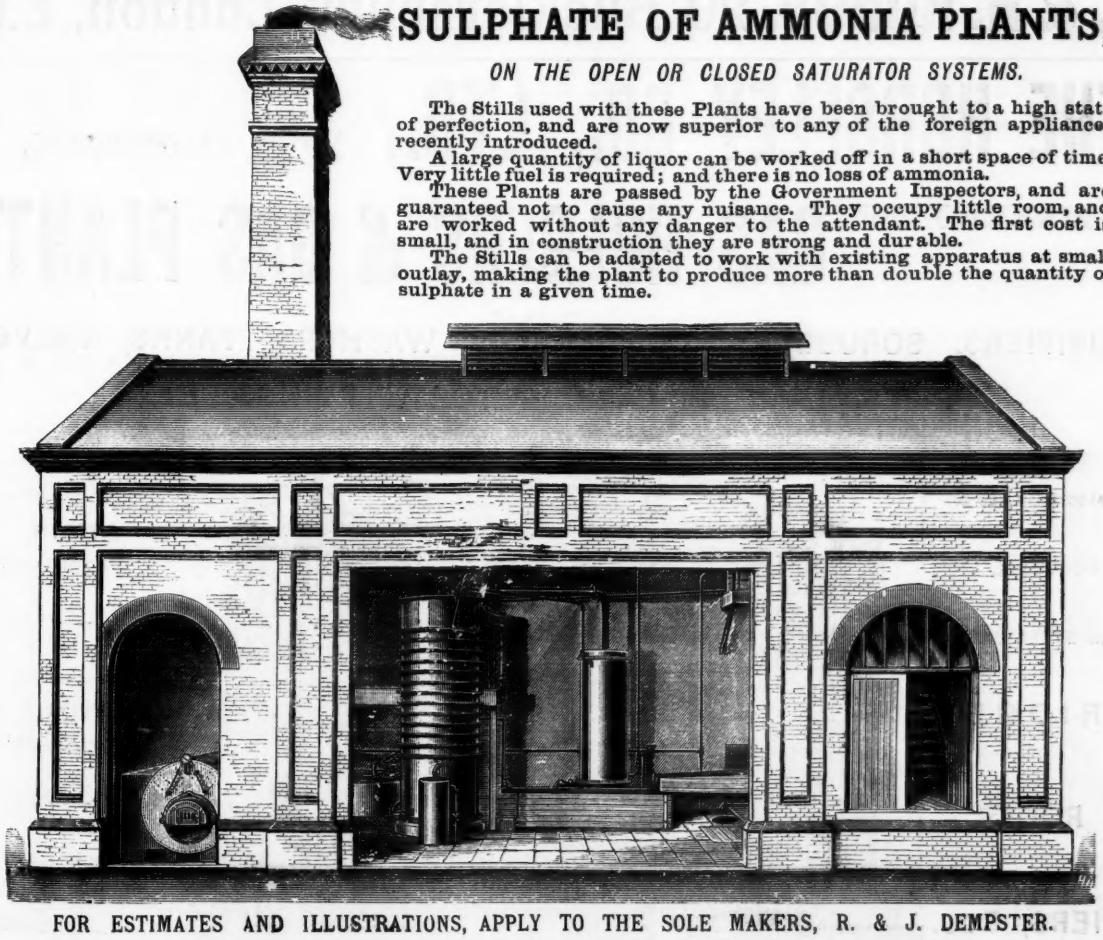

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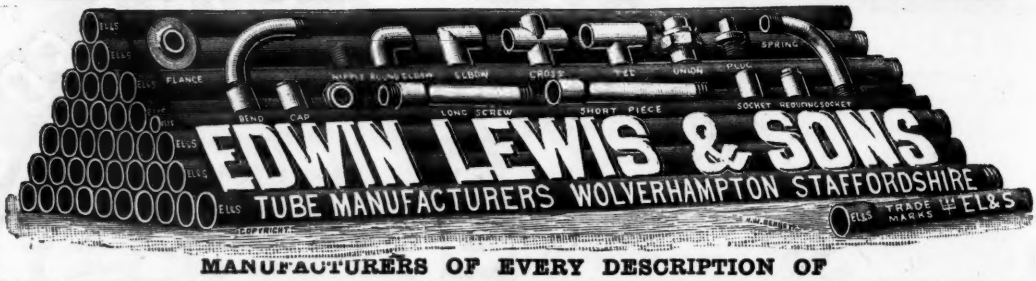

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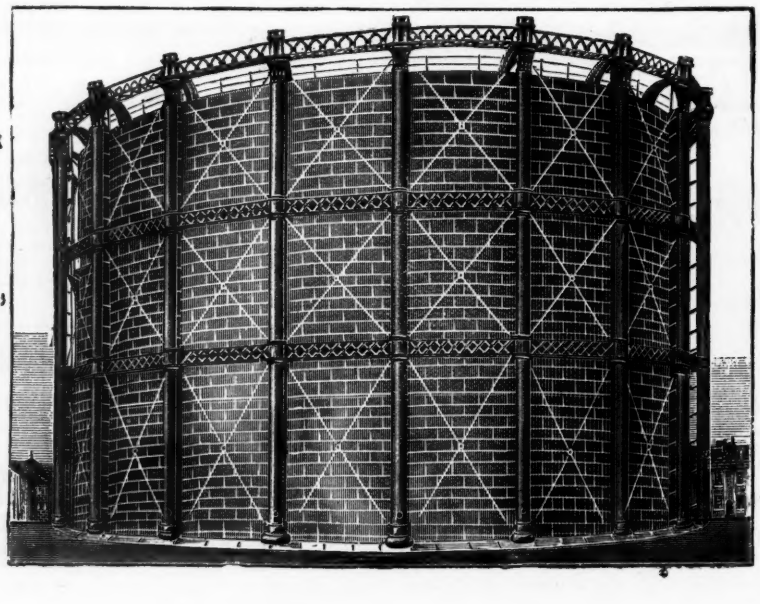

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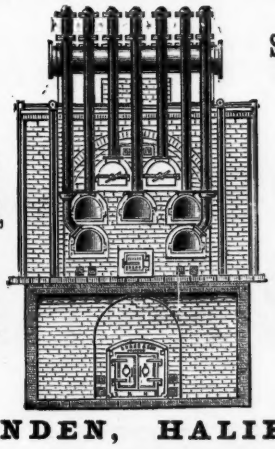

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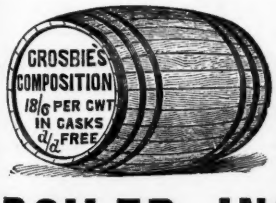

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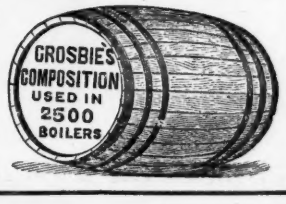

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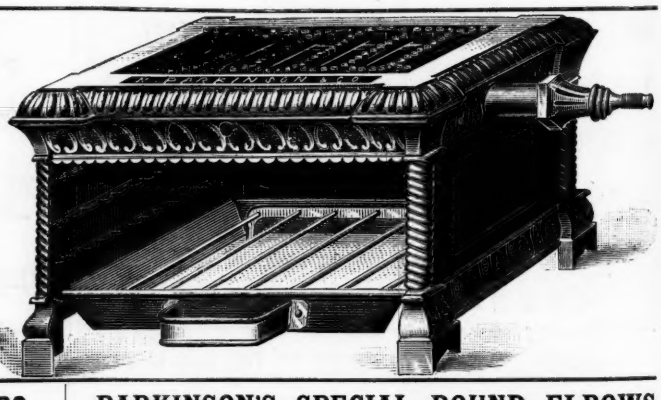

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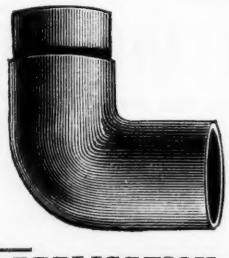

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[See also Advt. p. 1102.

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